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SCIENCE FACT — SCIENCE FICTION

THE DUELING MACHINE | by BEN BOVA and MYRON R. LEWIS

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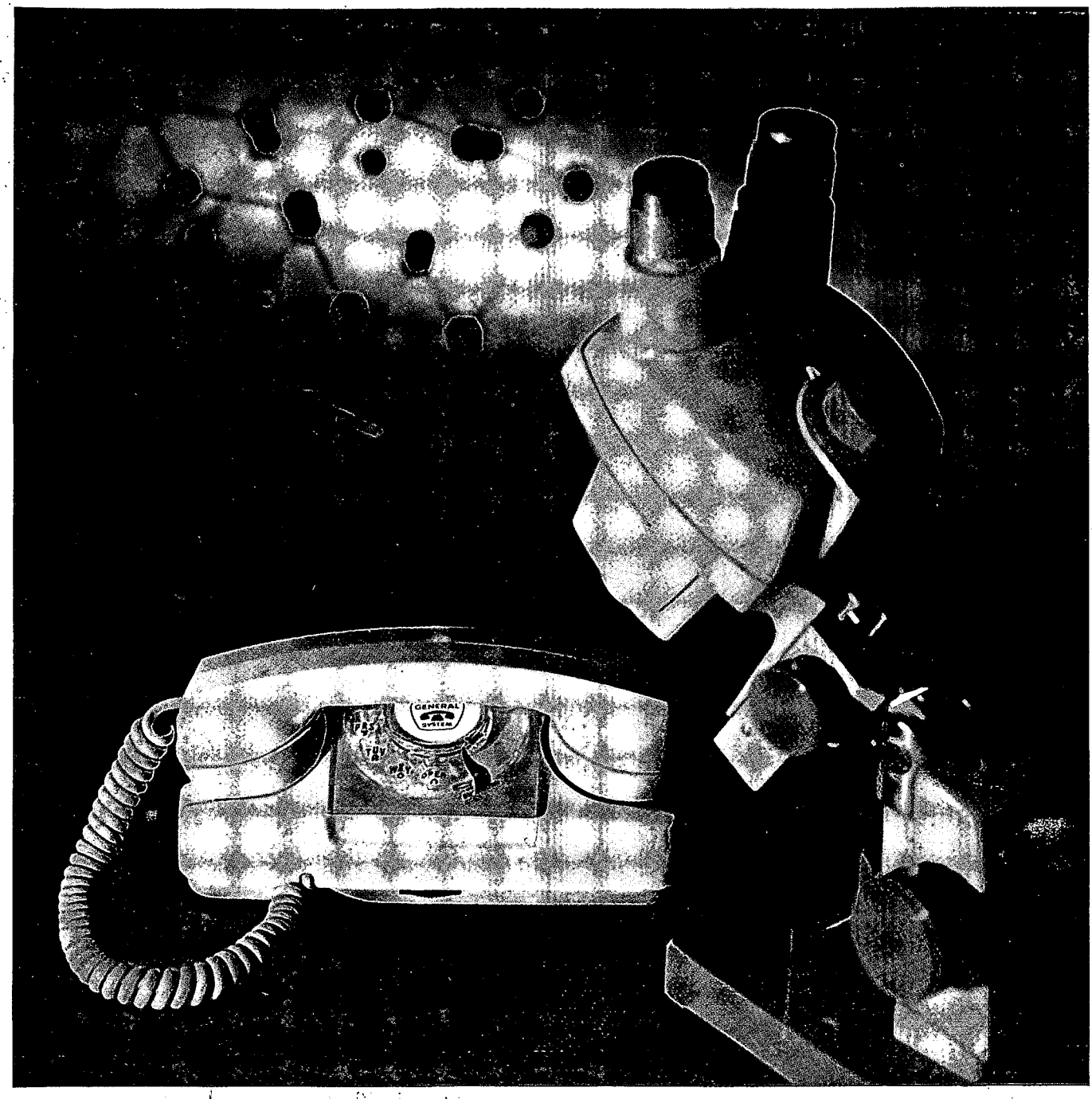

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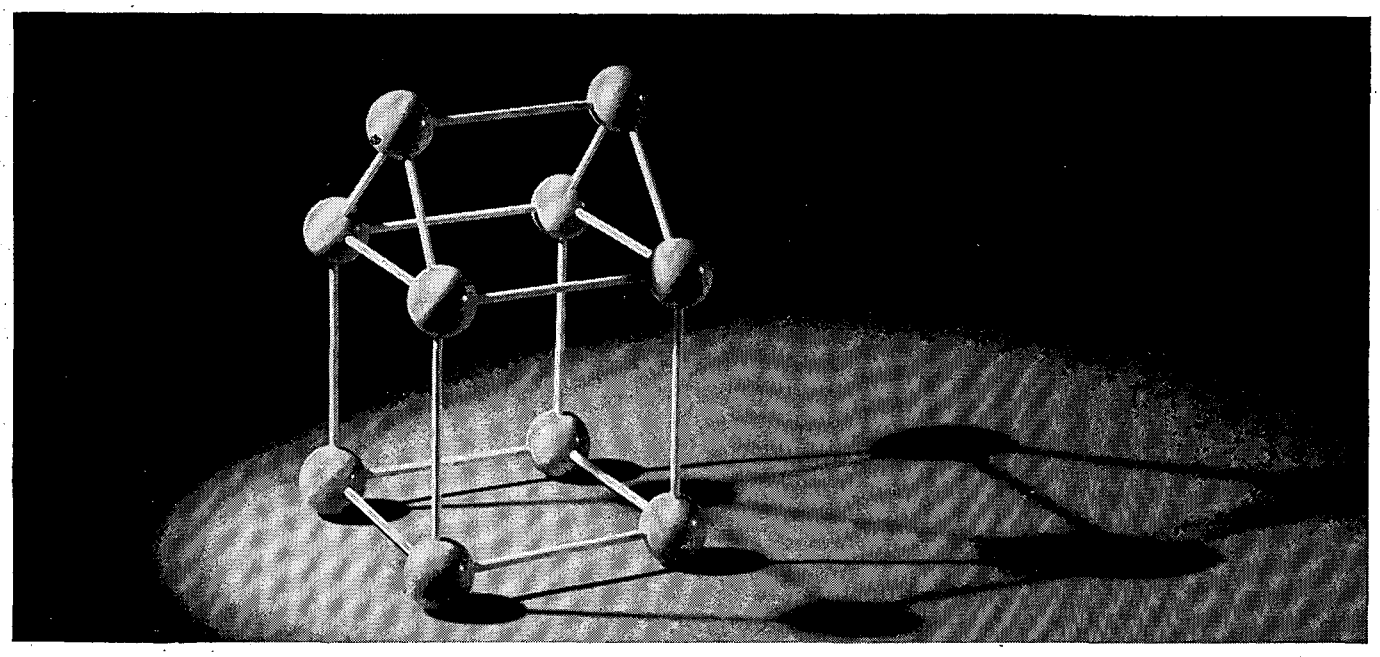

You see many references these days to chemical "building blocks." Rearranging molecules to create new materials is basic to modern chemistry. But did you know that *construction* materials are being made of chemicals? Let's look at two examples from our Barrett Division, leader in chemically based building products:

Vinyl building panels. These new polyvinyl chloride panels offer far more than the usual advantages of plastics (lightness, translucency, built-in color). First, they're rated as noncombustible. They've been given a fire-hazard classification, flame-spread rating of 25 by Underwriters' Laboratories, Inc., tunnel test. This makes them the first plastic structural building material to achieve a flame-spread rating that will permit virtually unlimited use in commercial and industrial applications. Second, they can be extruded in *any* length, and they have the flexibility to adapt to curves or unusual designs. Third, they're homogeneous—contain no fibers to block light or take in moisture.

Many uses besides siding and roofing are indicated for PVC: vacuum-formed shutters, gutters, downspouts, storm doors—even piping. *Why not write for a new technical data folder on Barrett® vinyl panels?*

Urethane insulation. Those familiar with the many successes of rigid urethane foam will not be too surprised at finding it in the building business. Key to its popularity here: low thermal conductivity (a "K" factor of only 0.15 at 70°F.). Compared to conventional insulating materials, it provides at least 50% greater thermal efficiency. It's particularly attractive to those who "sell space." A cold-storage operator, for instance, recently realized 13% more space by using urethane instead of glass fiber. Added plus: Urethane does not absorb insulation-breaking moisture, and can be applied directly with hot pitch or asphalt.

Barrett® urethane foam makes an excellent insulator for flat industrial roofs, too. Sandwiched between two asphalt roofing sheets, it becomes an easily applied, effective roof insulation that is ideal for electrically heated and air-conditioned buildings. *A free calculator is available with which you can gauge your insulation needs. Write us for it.*

Three Allied divisions make major ingredients for urethane foam: Nacconate® diisocyanates come from National Aniline, Actol® polyethers from Solvay Process, and Genetron® blowing agents from General Chemical.

Foam in the home. Chemicals can do a pretty extensive "furnishing" job, too. Urethane foam, in flexible form, will furnish a home with the most comfortable mattresses, pillows, and furniture cushioning imaginable. Makes fine, resilient carpet underlays, too.

Plastics in the home? Just ask our Plastics Division people. They make melamine for table tops, polyester for wall panels and chairs, polyethylene for floor polish and washable paint, urea for lighting diffusers and switch plates. And, of course, more melamine for that famous, virtually unbreakable dinnerware.

People who live in glass houses shouldn't forget our Solvay Process Division. Solvay supplies the soda ash used to make window panes—also the potassium carbonate used for fine crystal and television tubes. Chromic acid for chrome-plated appliances also comes from Solvay.

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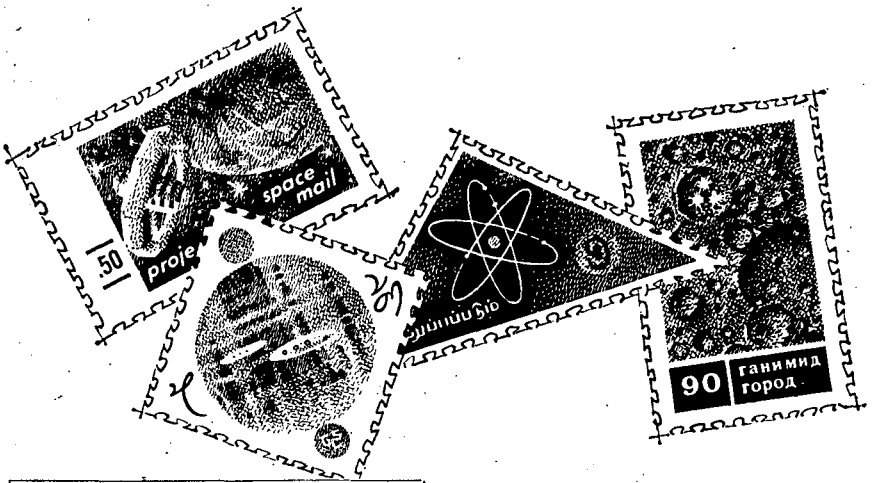

BRASS TACKS

Dear Mr. Campbell:

A recent "Letter to the Editor" contained the following sentence, apparently referring to the Drive, which I take the liberty of quoting: "Floating down the Potomac twenty feet above water in an antigravity car will bring all of the physicists you want at a dead run."

Let us hope not. Any "physicist" who does not distinguish between a demonstrable principle and a commercial application is not a physicist. We do not "want" him, at a dead run or otherwise.

I agree with your correspondent, however, that the average scientist, engineer, or the man in the street, cannot be expected to understand or even perceive a "principle" unless it is outlined for him. It is correct to do so in terms of behavior for, to be useful, it must be capable of demonstration under conditions that assure definition, repetition and predictability.

From other letters that have appeared in your magazine, it is apparent that many are not aware of the phenomenon upon which the Drive is based. We cannot be expected to discuss proprietary information and data, but there is no reason why the basic phenomenon should not be well understood. It is called "phasing," and this letter concerns that phenomenon.

This letter and its illustrations refer to and contain proprietary information and data. Permission is hereby granted to use for scientific and experimental purposes only.

First of all, to be clear:

The Drive is a transmission system having special characteristics.

It is an embodiment of our basic System or method patents which concern the erection and maintenance of dynamic structures through which energy is transferred.

Approaches to the System begin with the "phasing" phenomenon.

The "phasing" phenomenon is a descriptive term for the actual behavior, under specific conditions, of a common mechanical device called an oscillator.

It is not just the behavior itself that is of interest to us, but, because this particular behavior occurs, forces induced in the oscillator by the energy source can be made available and useful to us.

We will briefly mention these other properties which permit transference of energy, but this letter is directed to the fundamental and actual behavior of an oscillator, because this behavior is not supposed to occur at all.

Please note the words "actual behavior," because the actual and demonstrable behavior is not in agreement with a presently accepted, but erroneous, assumption of how it should behave.

The error is not in law; but in the assumption. The laws are valid; this particular assumption is not. The error arises from attempting to illustrate the principle of the Law of Conservation of Momentum under circumstances that induce forces which, in actuality, do not permit the supposed behavior to occur. Demonstration will show that the supposed behavior does not occur, never has occurred and never will occur.

The actual behavior is quite different and we call it the "phasing" phenomenon.

The simplest and surest way to compare fact and fiction is to demonstrate. We are not concerned with argument; we are concerned with fact. We recommend that anyone interested in the matter demonstrate the results for himself. This letter will show how.

The demonstrating equipment can be cheaply built with common and usually available materials.

But let us be quite clear as to the purpose of the experiment. That purpose is to compare a presently accepted, but erroneous, assumption of how a certain configuration should behave with how it does behave in actuality.

Then let us set up the demonstration and see for ourselves.

The equipment is described and illustrated in U.S. patent No. 2,886,976, entitled "System for Converting Rotary Motion into Unidirectional Motion." Look at illustrations 8, 9 and 10. From that shown equipment, consider only the oscillator, the bare frame it rides in, and the means of rotating the eccentric masses. Repeat —remove all springs, solenoids, clutches, tapes, electrical wiring and contacts. Omit even the spring shown in the driving mechanism.

Now set the outer frame level so that the oscillator won't roll "downhill" and will oscillate smoothly within its outer frame without hindrance, and with as little friction as possible.

Apply rotating force by means of two universals and a "slip-joint," or a very smoothly working flexible shaft. The object is to apply rotating force without the means influencing *in any way* the free oscillation of the oscillator that results only from the forces induced within the oscillator itself.

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Next, and *of utmost importance*, drive the rotors at reasonably *constant angular velocity*. Not just constant r.p.m., but at a constant change in angular velocity over 360 degrees in each revolution. An excellent method is to use a common electric drill. The heavily geared down motor does quite well for the purpose.

Provide a rheostat, or Variac, capable of controlling the speed of the drill from very low on up. It does not need high speed, unless you want it and have the means of closely observing it that way. At any speed above that required for full amplitude of oscillation the results are the same. The amplitude of oscillation tends to remain constant irrespective of speed of rotation. Equipment has performed satisfactorily from 120 to 1800 r.p.m.

Don't worry about the parameters of the oscillator, but try to keep its frame and parts as light as conveniently and safely possible in relation to the weights of the eccentrics. One to one ratio is excellent. Something more will do quite well. Keep it simple and make it smooth.

Now cut out a disk of plastic or paper and draw a heavy line from the exact center to the outer edge. Also, preferably, draw a light short crossbar through the exact center point to show exactly where the center is at all times. Mount this disk on the outer end of one of the axles with its center exactly at the center (axis) of the axle and with the heavy line running exactly through the very center of gravity of the eccentric mass on that axle.

In front of it, fixed to and riding with the oscillator, mount a thin piece of transparent plastic with two long crosslines at right angles. It is mounted with the center of the crosslines at the center of the axle disk, with one line parallel to the plane of oscillation and the other vertical to it.

Finally, set up, outside of the oscillator, either on the exterior frame or on the testing bench, a stationary exterior "frame of reference" to which

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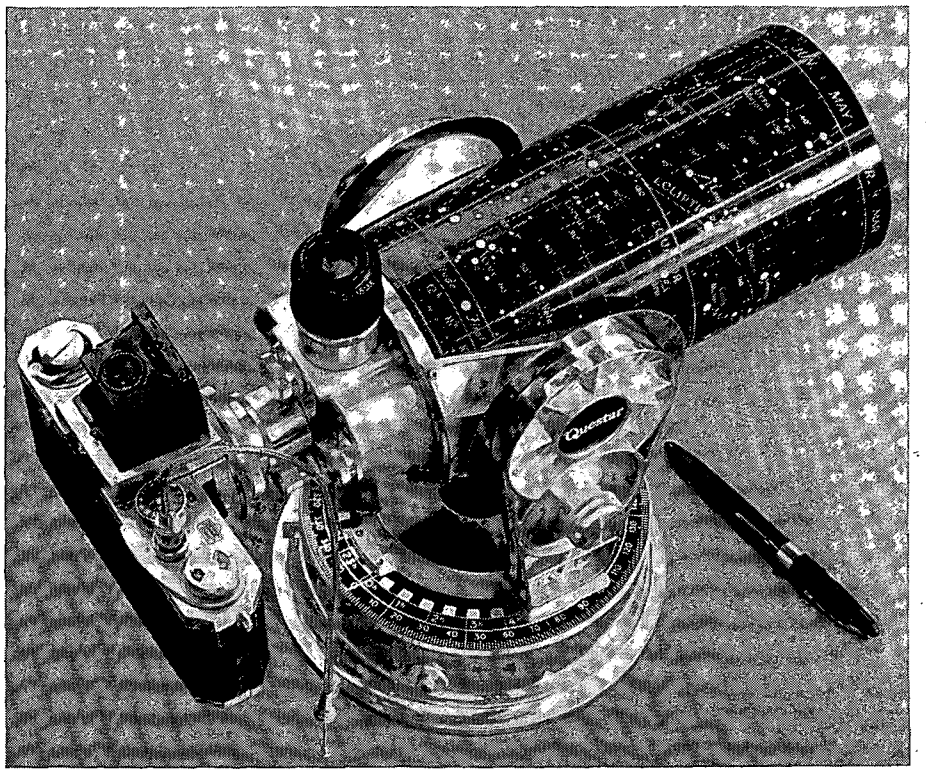
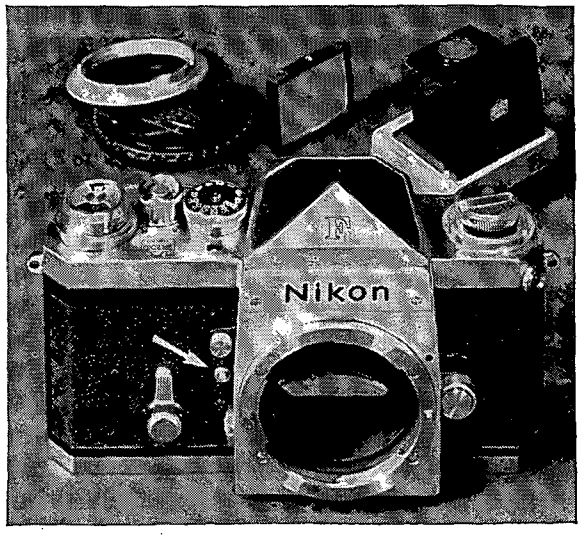


May we tell you about the first wholly satisfactory camera body for use with Questar? It is a special Questar-modified Nikon F, obtainable only from us.

The problem of taking high resolution pictures through the superfine high-power Questar telescope on 35-mm. film can be reduced to three principal factors: lack of vibration, sharp focus, and correctly thin negatives. The last critical factor, exposure time, can now be measured at the image itself with a CdS lightmeter at Questar's 40x eyepiece.

Vibration during exposure is our chief enemy. Images of perfect optics are formed by an infinite number of overlapping perfect diffraction images. The tiny round dot of Questar's diffraction image, the Airy disk, is only about .0002 inch across. When a reflex mirror slams up a fraction of a second before the roller-blind curtain slit sweeps across the film, a vibration is usually set up of some .001 inch amplitude. Pictures taken before these oscillations are damped out give a fuzzy picture when enlarged. Standard Nikon F bodies can lock the mirror up, allowing the featherweight ball-bearing titanium foil focal plane shutter to work alone with a visible shock of only the dot's width, most of which is post facto effect, after exposure. This gives us negatives so sharp we could not tell them from those taken by waving a black card. But being blind between exposures is most annoying. The arrow points to the Questar modification, a tiny button which releases the mirror any time after you have checked everything and are ready to expose. Price of Questar-modified standard Nikon F body, as shown, is $259.60 with bakelite cap. (We regret that we cannot have your own Nikon body modified.) Cable release, $3.95. Photomic finder, $99.50. 50-mm. f/2 Auto-Nikkor Lens, $90.00. Auto-Nikkor f/1.4 50-mm. Lens, $155.00.



Sharp focus has always been a problem with long-focus telescopes. With camera close-coupled, Questar works at f/16 at 56 inches. With 2-inch extension tubes to reduce vignetting, f/18 at 64 inches. These focal ratios give such dim views that the image is hard to see. The standard split-prism rangefinder works only with fast, low f numbers. But Nikon's Type C interchangeable groundglass, with clear center and hairline cross, at $17.50, gives brilliant images with a mark to keep the eye from accommodating in front or behind the focal plane. At right is the waist level finder, $22.50, which permits best view of the Type C cross with eye up close to its lens.

The new cadmium sulphide light meters, with their small openings, have been used by Questar owners to apply directly to visual eyepiece or camera views of the image, to get an actual reading of what the image unit brightness is regardless of magnification of all nature's variables. We have little data on this at present. Recalibration is necessary, but we hear it is simple. At long last we can completely ignore the variables of nature, due to geographical location, sun's intensity, water vapor, time of year and day—all the guesswork which makes exposure tables impossible. The able photographer may locate the subject with Questar's 40-80x eyepiece, then pop the CdS cell over exit pupil of ocular and take a reading to determine speed.

At upper left is a new, more compact ring adapter, $10.00, to secure Nikon F bodies to Questar's $23.50 basic camera coupling outfit, a multi-purpose device described in detail on page 26 of the Questar booklet. Questars still cost only $995, or $1100 with quartz mirror for best thermal stability. Each is a gem of superfine optics, whose sharpness might eventually be equalled, but can never be surpassed.

QUESTAR

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LIFE AMONG THE STARS

Editorial by
JOHN W. CAMPBELL

When I was going to high school, some thirty-five years ago, I was first encountering—in the works of Sir James Jeans, and Sir Arthur Eddington—accounts of the structure of stars, galaxies, and atoms. And one of the greatest mysteries then bothering cosmologists was how this planetary system came into existence. There were lots of theories—but none of them very satisfactory.

It seemed at the time that the creation of stars was readily explained in terms of condensations, under gravitational attraction, from the immense gas-dust clouds of the galaxies. But the formation of planets was inexplicable.

There was the theory that our Sun had been struck a glancing blow by a passing star, and another that suggested a close passage with gravitation-tidal effects tearing masses of solar material out into space to condense into planets. The even older Laplacian Nebular hypothesis proposed that the planets formed out of the gas cloud that was in process of condensing into the Sun.

In each, however, it appeared that the creation of the planets was an all-but-impossible accident—a one-in hundreds-of-millions event.

We still don't know, of course—but we are, now, able to consider a considerable number of factors that weren't included in earlier efforts to figure it out. For one thing, magnetic field effects are now known to be immensely more important in cosmic affairs than was believed, even twenty years ago.

More important, all those one-in-hundreds-of-millions theories had to be abandoned when it was shown that several of the nearer binary star systems showed definite evidence for the existence of giant, massive planetary satellites. It was all very well to say, "Well, it is true that it couldn't happen more than once in hundreds of millions of times—but we wouldn't be here to question it if it hadn't happened!" so long as there was only one planetary system to be explained.

But now that we know that several stars do have planetary type companions—i.e., "dark stones" in the modern astrophysicist's terms, meaning non-self-luminous, and composed of crystalline, not ionized gaseous, matter—some less improbable mechanism for planetary generation must be developed.

What that will be, we don't know yet—but it must come. And, meanwhile, one of Man's great questions will be precisely what last month's article discussed—"Which Stars Have Planets?" And a second, and entirely separate questions: Of those planets which circle stars—which might be habitable. And among the habitable, which might be inhabited?

The latter two classes are not by any means identical. It appears fairly certain that the development of life on a planet requires not merely millions of years, but billions of years. Assume a planet comes into existence, and circles a star of such radiant power, at such a distance, as to have the general climatic conditions Earth now possesses. It has the methane-ammonia-water vapor-hydrogen atmosphere that seems to be standard for newly formed, pre-life planets, and it circles its sun-star for a hundred million years.

Everything we know today strongly suggests that that's far too short a

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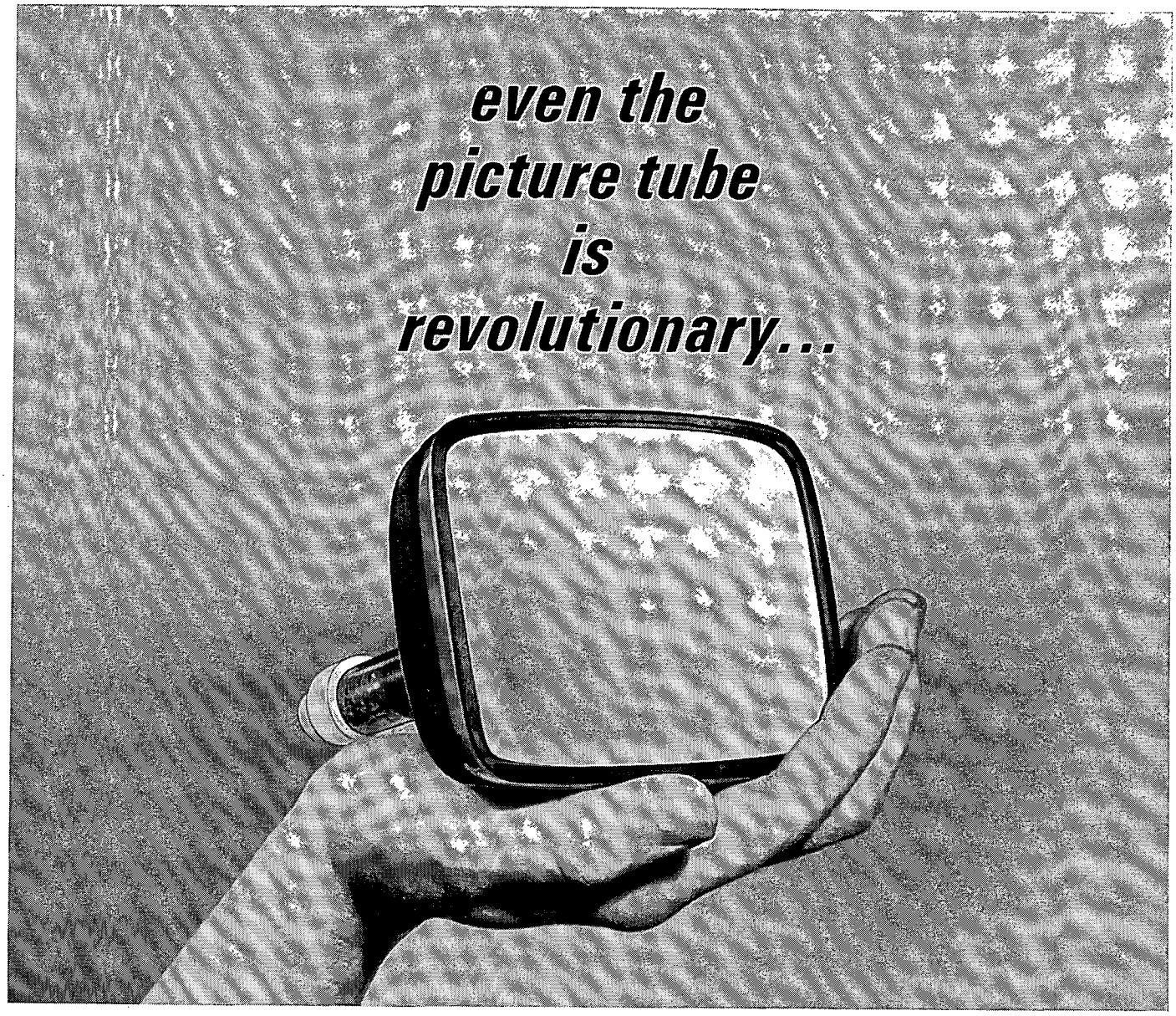
even the picture tube is revolutionary...



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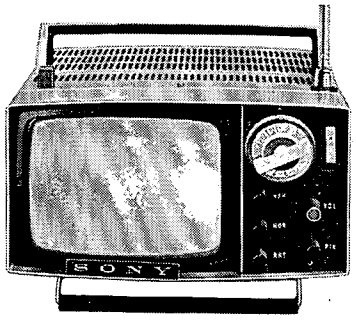

There are many remarkable firsts in the new 25-transistor SONY Micro-TV. Not the least of them is the unique picture tube, designed, engineered and manufactured by SONY. Only by using 70° deflection—the first on a commercial set—with a phenomenally low drain gun and radically new phosphors, was SONY able to bring you unbelievable picture quality. Yet Micro-TV is hardly larger than your phone, and weighs a scant 8 lbs. Another SONY first is the use of snap-out circuit boards which permit you to send them directly to our service centers for the replacement of a defective component. Micro-TV operates on rechargeable battery pack as well as 12v auto/boat power and AC. **$189.95.** Rechargeable battery pack, accessories extra.

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Editorial

Continued from page 6

period for anything we would identify as "living" to develop. It appears to have taken almost 1,000 million years for life on Earth to go from the first self-reproducing DNA molecules to such enormously evolved organisms as single-celled animals and plants.

So it would be quite possible to have a planet which was ideally suited to life—but no life on it yet.

I have not seen, clearly stated, in any of the now-available general books on cosmology and astronomy, a fact that appears to be "why, everybody knows that!" type information among astrophysicists. To wit: The galaxies—including this one!—*do not have a spiral structure.* They are made up of vast disks of stars, quite uniformly distributed about the galactic center of gravity, orbiting about that center in quite normal orbits—which latter fact makes the "spiral structure" completely impossible, if you think about it for a moment.

Suppose that, somehow, we lined up the Solar planets, placing them all neatly in a straight radius-line out from the Sun—Mercury, Venus, Earth, Mars, Jupiter, Sturn, Uranus, Neptune and Pluto, all lined up (the way they appear to be arranged in some of the early science-fiction stories touring the solar system). Since each planet has its own orbital velocity and period, imposed by the laws of motion and gravity, that alignment won't last a day! In forty-four days, Mercury will be on the opposite side of the Sun, Venus will have swung well around, Earth will have moved more than a tenth of the way around . . . and Neptune will be practically where it was to begin with. It moves slowly in its vast orbit, and has a stupendous distance to go.

The straight-line arrangement will be broken up at once; for a very brief while, the inner planets will appear to be in a spiral arrangement curling around the Sun—but by the time Venus has made one swing around, the positions of Mercury, Earth and Mars will appear merely "random," while Saturn, Uranus and Neptune will appear not to have moved.

Pluto? Oh—you won't see that anyway! It's too inconspicuous. Even with a fairly good portable telescope, you can't find Pluto.

Since the stars of a galaxy are in orbit about the center of gravity of the galaxy, necessarily they, too, move at different speeds, and have vastly different periods of revolution. *If* the galaxy started out with a nice, neat spiral structure—within one revolution, that spiral would have been completely scrambled. Because . . . what does the "period of rotation of the galaxy" mean? It doesn't rotate as a solid disk!

But . . . everybody has seen the pictures of the galaxies, and they are conspicuously spiral in form! What's going on here, then . . . ?

The answer now appears to be that there are *conspicuous* spirals—but that the key word is "conspicuous" *not* "are"! Paint a spiral of white paint on a piece of black cardboard, and hold it up on a dark night two hundred feet from an observer, and he will clearly see that you are holding a spiral made of some white material. The cardboard, of course, will be invisible. The structure you are holding may *be* a disk, but will *appear* to be a spiral, simply because the spiral of white paint is the conspicuously visible portion of the structure.

The "spiral arms" of the galaxies sparkle with brilliant, hot blue-white giant and super-giant stars—stars 10,000 to 100,000 times as luminous as our Sun, visible therefore at immense distances.

The trouble is, of course, that observation never determines "what is," but, by definition, only "what appears to be." In the immediate neighborhood of the Sun, there appear to be some forty stars within 16.5 light-years . . we think! A Schmidt camera plate records so many tiny points of faint light as to make reduction of the data recorded hopeless —too much information. There may, in fact, be not forty but four hundred stars within that 16.5 light-year region—but they're dim points of light, visible only in major telescopes, and so inconspicuous as to be indistinguishable from the millions of stars at all distances, and lost among them.

The list of those forty-known-to-be-near stars shows a luminosity range from 7/100,000ths that of the Sun (Proxima Centauri) up to a maximum of thirty times the Sun (Sirius). Not having a computer handy I haven't derived the actual average luminosity of the whole forty, but scanning the table suggests that it's on the order of 1/1,000th the luminosity of the Sun.

Obviously, stars of low luminosity are going to have to be nearby if we're to detect them at all; Proxima Centauri is the dimmest star listed . . . and, of course, the closest!

Now the stellar mass-luminosity relationship is such that luminosity increases at a high, exponential rate with increasing mass. A star ten times the Sun's mass isn't ten times as bright—it's hundreds of times as brilliant. There's reason to believe from nuclear-astrophysical theory that no star can have a mass of one hundred times the Sun's and remain in one mass for any detectable period —the rate of energy release would be so enormous as to blow the mass into more reasonable-sized fragments.

But this relationship works both ways; stars *far* less luminous than the Sun have nearly the Sun's mass. Thus Sirius, with a mass only 2.4 times Sol's is thirty times as luminous, while 61 Cygni A, with a mass seventy per cent of Sol's, is only ten per cent as bright, while Kreuger 60B is only 1/1,000th as luminous as Sol, yet sixteen per cent as massive.

Clearly, then, nearly all the stellar mass of a galaxy will be in the form of stars of luminosity far less than that of our Sun. Stars so dim that our best telescopes wouldn't see them even at a distance of a hundred light-

Continued on page 87

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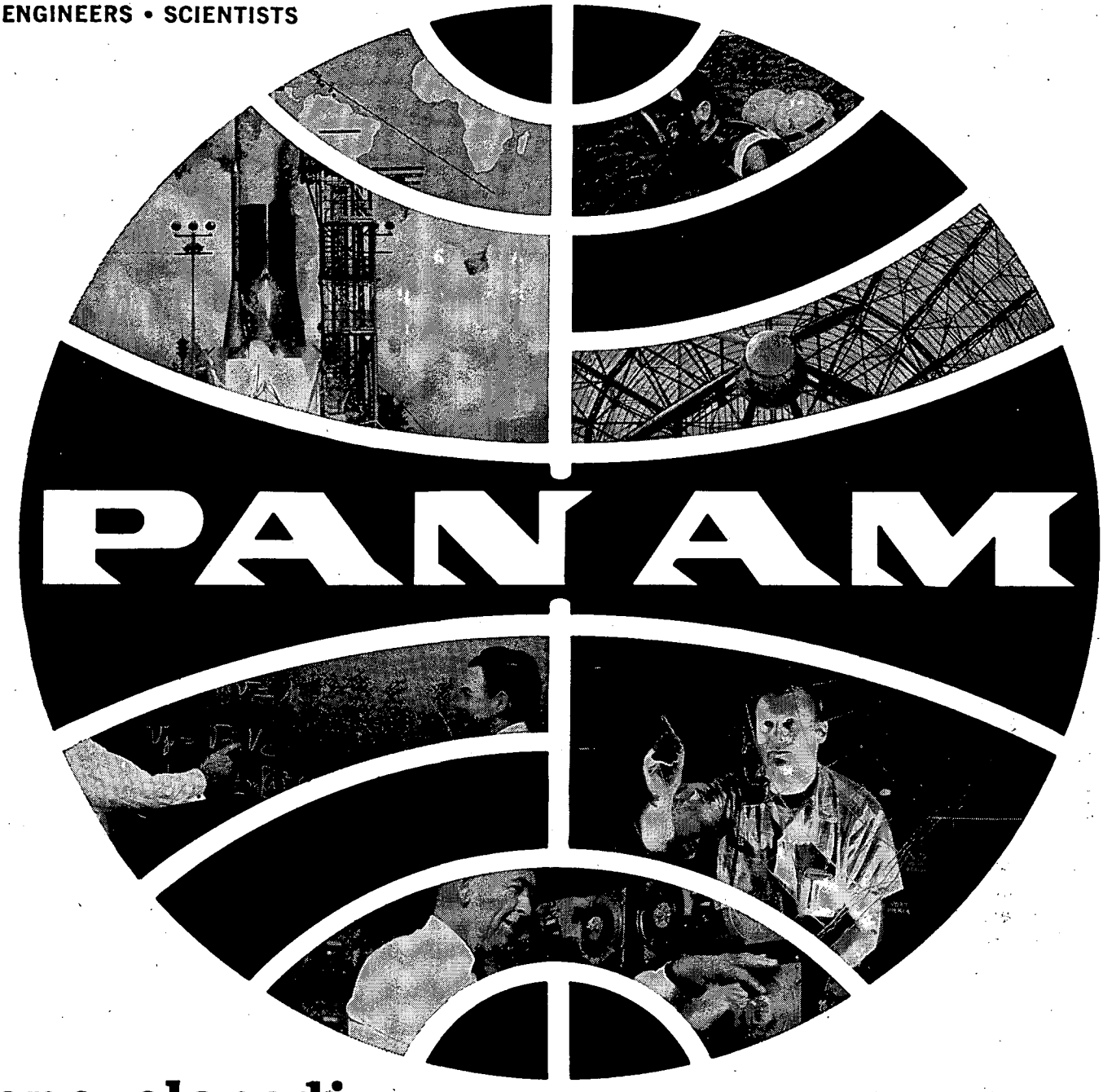

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by **GEORGE W. HARPER** □ The surface markings of Mars have been a challenging mystery largely because we can only half see them. In the best telescopes, Mars is somewhat less visible than our Moon is to the naked eye! And we know so little about planets; we've been able to examine only one and a half—Earth, and it's half-planet companion.

The fact that the seventy-five years since Schiaparelli's famous announcement of the existence of *canali* on Mars have failed to produce any significant agreement on the more detailed markings of the martian surface suggests that a new approach is required. Aside from the possibility of actual physical exploration or the dispatch of successful instrumented probes, any such approach must be both analytical and theoretical. Instead of picking out specific details and attempting an explanation one at a time, the planet must be treated as a unitary whole which is also a part of the solar system.

In order to accomplish this with any hope of success we must first look briefly at some of the limitations of the equipment with which we must work. The telescope, of course, is the chief of these devices and it is precisely this instrument which gives us our most ambiguous results. At its nearest approach to earth, Mars is some 5.6 x 10^7 km. (35 million miles) distant. At this range Mars appears as seen in Figure 2.* This is roughly twice the apparent diameter of the full moon as seen at apogee with the naked eye, and since Mars is almost exactly twice the diameter of the moon this means that a comparison between the two bodies is valid so far as it goes. But there are additional complicating factors which are not present in naked-eye observation of the moon. For one, Mars has an atmosphere, so in addition to the necessity of peering through earth's atmosphere we also have to penetrate a second atmosphere on the other end. Since the albedo of the moon is classed as seven per cent while Mars is rated at fifteen per cent, this means that perhaps as much as half the reflected light of Mars is pure static; meaningless light bounced back from the atmosphere.

Nor is this all. The very time when Mars is closest to earth is the time when it is least possible to see detail! The light from the sun reflects back flatly and fine points of shadow and contrast are almost completely lacking in the dull, reflected glare. Taken as a whole, *this means that we can see the moon better and in more detail with the naked eye than we can see Mars with the best telescopes on earth!* To give a fair comparison, therefore, Fig. 1 is a photograph of the full moon taken under fairly sloppy seeing conditions. Using this as a basis, try to recreate the surface of the moon as we know it to be. It would be sheer coincidence if the resultant sketches happened to coincide with reality.

So far as the basic data of the planet is concerned, there are many points of general agreement which may be briefly summarized. The mean orbital distance is taken to be 227.9 x 10^6 km (228 million miles) with a margin of error of not more than ± 3 x 10^4 km according to the most extravagant estimates. This means that on the average Mars receives some 43% of the solar radiation per unit of surface area as earth. Allowing for an orbital eccentricity of 0.093, the extremes of solar radiation per unit of surface area become respectively 34% and 51% of earth norm. The equatorial inclination of 25°12′ and the rotational period of 24½+ hours are sufficiently earth-like to assure a relatively even distribution of what radiation is received. If we ignore special problems of atmospheric composition and for the time being assume merely an atmospheric density 25% that of earth and with similar greenhouse effects, we may then conclude that the equatorial midday temperature at perigee must approximate +24°C. (+75°F.), while at aphelion it will average out to around +10° (50°F.). Nighttime equatorial temperatures at aphelion and perihelion respectively will probably not fall below −29° and −1.1° (−20° & +30°F.). By comparison, at the polar regions the minimum temperatures will approxi-

Fig. 1: Half-Moon, seen through metropolitan haze, 500mm lens on 35mm camera.

* Increasing the size of the mirror from 36″ to 200″ would not substantially increase the apparent size of the disk. The larger mirror is designed merely to increase the amount of light received and is used primarily for intergalactic distances.

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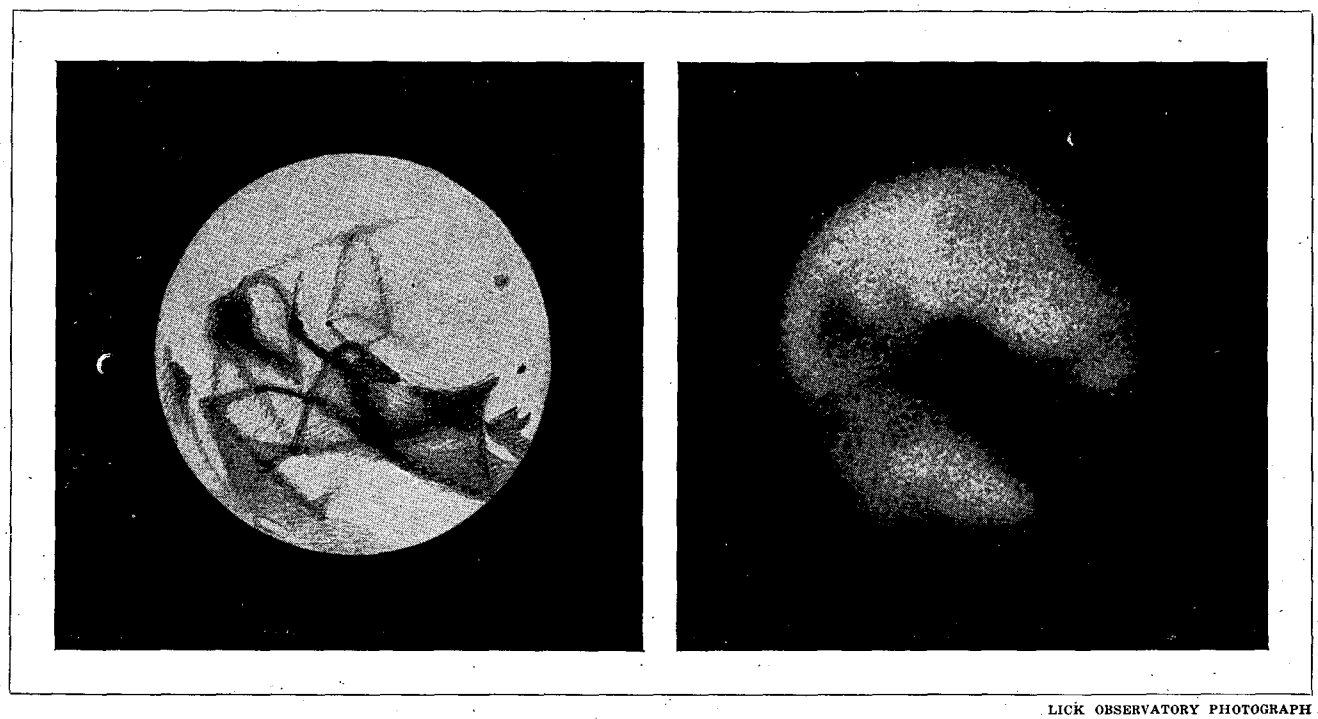

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Fig. 2: Comparison photograph and drawing of Mars made at the same time. The human eye can often catch fleeting distinctions missed by a photograph. Conversely, a human drawing cannot quite render degrees of shading exactly and the boundaries of surface markings become more pronounced than is really the case.

mate —107° at midwinter aphelion while the maximum at summer perihelion will perhaps exceed +5° (—160° & +41°F.)

As implied, to a considerable extent these temperatures are contingent upon the accuracy of estimates of the character and density of the martian atmosphere, and as both of these factors are subject to discussion it is entirely possible that the temperature estimates may be off by as much as 10°, but scarcely by much more than that. Nor is the thermocouple of too much assistance here. The temperature readings are accurate enough as far as they go, but the situation is such that there is no assurance that the reading is actually that of the surface. It may easily be only an average of the temperatures between two points, one of which lies an unknown distance above the planetary surface.

The surface gravity is known within fairly narrow limits. The apparent diameter of the martian surface indicates a planetary radius of between 3388 and 3400 km, depending upon the uncertainty of the actual distance to the planet. The inner satellite of Mars, Phobos, orbits at 2.76 radii once every 0.318910 terrestrial days, which is consistent with a surface gravity of from 372.3 cm/sec^2 to 373.6 cm/sec^2. The comparable figures for Deimos are 371.2372.5 cm/sec^2, based on a mean distance of 6.91 radii and a period of 1.262441 days.

A minor problem here is the uncertainty of the actual number of planetary radii separating the planet from the satellites. Routine methods for determining the atmospheric depth contrast two photographs of the planet taken with red and blue sensitive filters respectively. The blue filter has little penetrating power so the photographed disk includes the atmospheric blanket. Red, on the contrary, penetrates to the surface and the resultant image gives the surface diameter. The contrast gives the depth of the atmosphere (Fig. 3). But unfortunately, while the blue filter possesses little penetrating power it does possess some. On the other hand, the fact that photographs taken with the red filter show a slight haziness around the perimeter indicates that some of the atmospheric blanket is included as a part of our computation of the surface diameter. Assuming a modest 5 km to be added to the planetary radius as a consequence of this included atmosphere, we arrive at a surface acceleration of 374.7 cm/sec^2 and an escape velocity of 5.044 km/sec for the planet. From this we conclude the mean density of Mars to be 3.95 gr/cm^3, as contrasted with 5.52 gr/cm^3 for earth.

Returning to the matter of atmosphere, we have already observed that

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the blue filter subtracts somewhat from the upper reaches of the atmosphere while the red filter does the same to the lower limits. This leads to serious problems when we attempt to determine the quantity of the gaseous envelope. The subtraction from the upper limits is of little practical significance. At best it could involve only a small fraction of one per cent, comparable perhaps to the error which would be introduced if we computed the total volume of earth's atmosphere and omitted all gases above the forty-mile mark.

But any subtraction from the lower limits is extremely serious. The median atmospheric pressure for earth falls about 5.6 km above the surface. On Mars we can expect the median to fall between 7-8 km above the surface since the pressure engendered by the lesser gravity rules out any possibility of an earth type density even if the physical mass of the atmosphere were comparable. An error, then, which subtracted 5 km from the lower atmosphere and added it to the planetary radius proper, would in effect be subtracting nearly 40% from the total volume. This must be borne in mind when we estimate the volume of martian atmosphere per unit of surface is only about 25% that of earth while the pressure is only some 11%. These are minima and the true figures may be as high as 35% and 18% respectively.

To analyze the composition of the atmosphere is no less difficult than the attempt to analyze its density. Some things, however are reasonably certain. Lack of individual points of exceptional albedo apart from the poles suggests the absence of any considerable bodies of standing water. This lack, coupled with the certainty that the martian atmosphere is gradually seeping off into space, has prompted various observers to conclude that the polar "ice" caps do not consist of water. It is suggested that the atmosphere would escape mostly in the order of molecular weight with the lighter vapors and gases escaping first.

Undoubtedly this will ultimately prove to be the case, and may presently be correct, but at the moment we have no legitimate reason to assume that matters have gone this far. Certain observations are indicative, but none so far are conclusive. The observational data itself is uncertain and a brief recapitulation is in order.

So far as the solar system itself is concerned, nitrogen appears to be one of the chief constituents of the atmospheres of the lighter planets. A number of factors apparently contribute to this result. For one, every planet presumedly is in the process of losing its atmosphere. No matter what the escape velocity or temperature, some fraction of the molecules

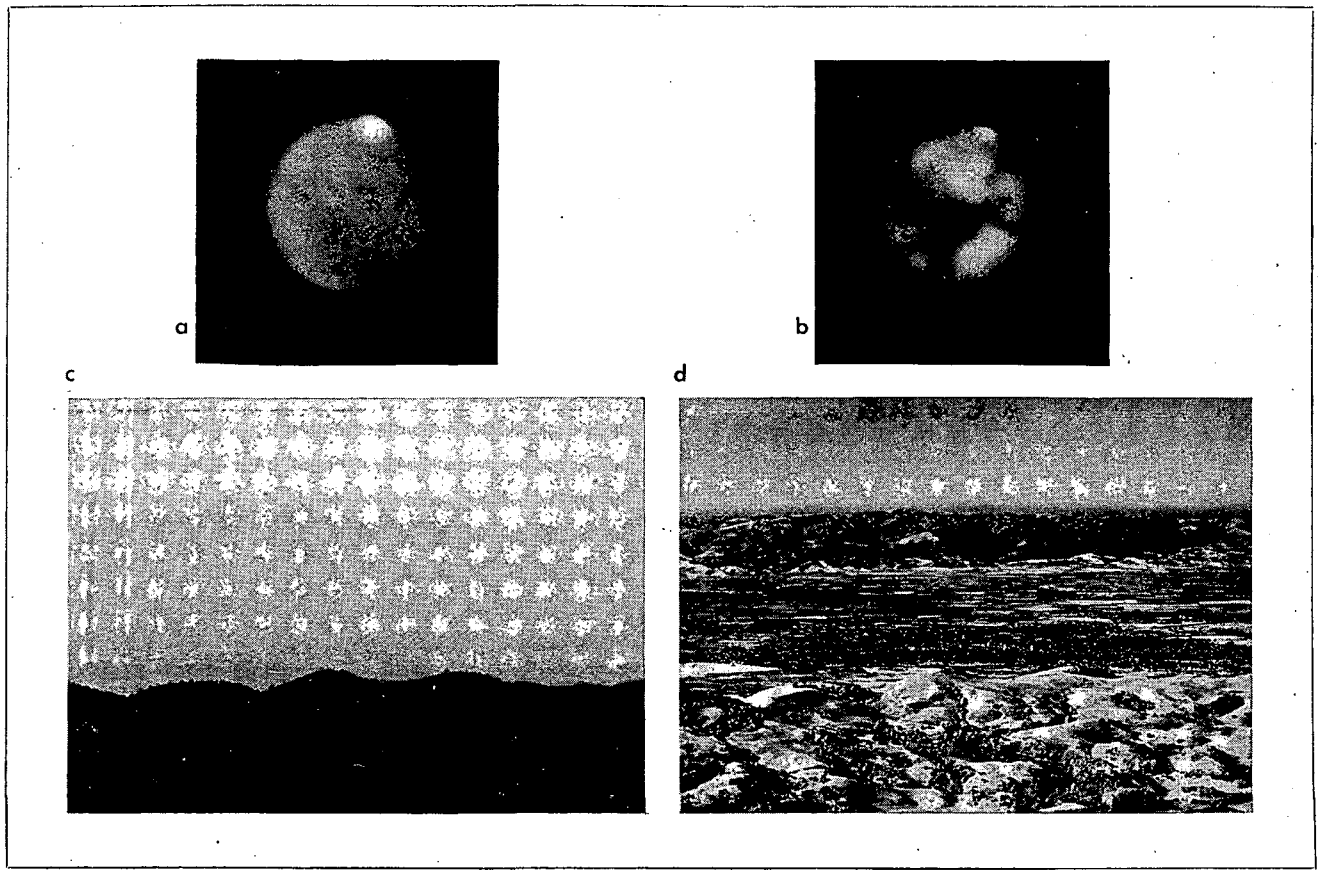

Fig. 3: Mars (Sept. 11) and San José as photographed from Mount Hamilton, (a) and (c) with violet, (b) and (d) with infra-red light. The obliteration in (c) is due to the Earth's atmosphere and comparison is suggestive of the presence of an atmosphere of considerable density on Mars. San José is distant 13½ miles. G.M.T. of Mars observations: (a) 18h 50m (b) 18h 30m.

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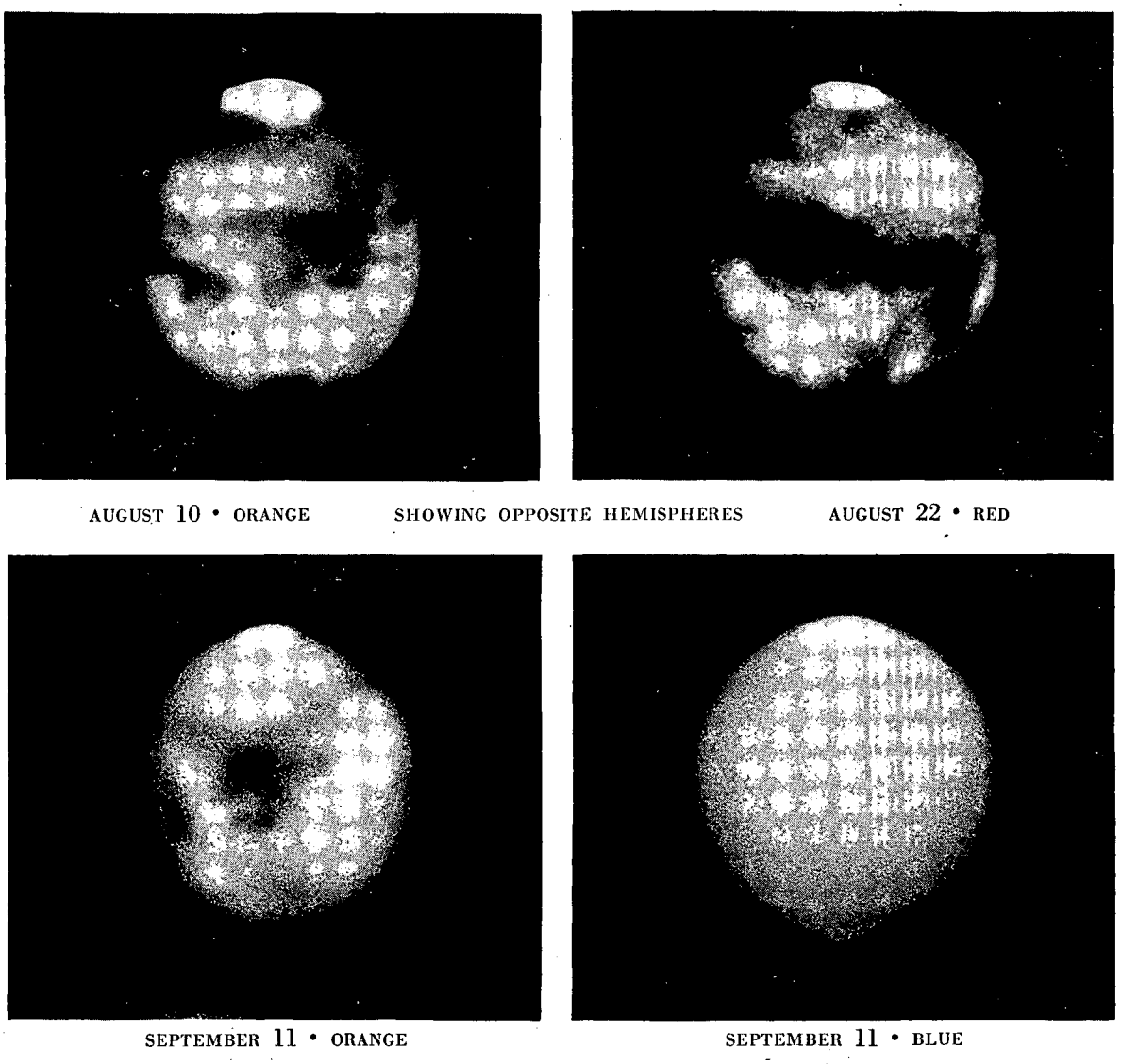
MOUNT WILSON AND PALOMAR OBSERVATORIES

Fig. 4: Mars, 1956



AUGUST 10 • ORANGE — SHOWING OPPOSITE HEMISPHERES — AUGUST 22 • RED

SEPTEMBER 11 • ORANGE — SEPTEMBER 11 • BLUE

at some level above the surface will possess kinetic energy sufficient to propel them off into space. The only difference between a planet such as Jupiter and one such as Mercury is the time required to bring the process to completion. The former may require more than 1×10^{11} years to lose a tenth of its atmosphere while hot little Mercury will breathe its last gasp in one or two millennia.

Since the lighter gases will be the first to escape we can expect that the proportion of hydrogen will be less in the smaller planets. Additionally, the more inert the gas the less the chance of its being trapped in some nongaseous compound. A final contributing factor is temperature. In general, the higher the temperature the more rapid the chemical reaction. The net result of these factors so far as the small, inner planet is concerned, is to weigh the atmosphere heavily with nitrogen. The hydrogen has mostly escaped. The inert gases are generally too rare to be significant, and the oxygen is taken up by the soils in the form of oxides.

Applying this to Mars, we conclude that it can hardly have a smaller percentage of nitrogen than that found in earth's atmosphere. We, therefore, reason it must be in excess of 78%. Moreover, direct spectrographic analysis supports this conclusion. The problem then, appears to be the constitution and quantity of the lesser gases, and it is precisely at this

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point that spectroscopic analysis becomes inconclusive. Some reports show no evidence of oxygen or water. Others reputedly show minor traces. The existence of CO_2 has a similarly inconclusive status. Thus, while the spectroscope may offer occasional suggestions, it cannot decide the issue without a further refinement of technique. But in the interim there are other items of observational data which can be used as indicators of the probable composition of the atmosphere. The "ice" cap is clearly the most significant of these, but the seasonal changes of appearance are very nearly as important. Fig. 4 most clearly illustrates the polar cap under its various aspects.

Commencing with the onset of winter, we observe a whitening which starts at the poles and gradually extends toward the equatorial regions, occasionally penetrating as far as the fortieth parallel. With the coming of spring the cap recedes towards the poles. As it recedes it becomes outlined by a darkened region which gradually fades with the onset of summer. This indicates the existence of a liquification stage in the substance composing the polar cap and therefore rules out the possibility of frozen CO_2 as the chief constituent.

To analyze the matter, the substance forming the polar cap must have a freezing point ranging somewhere between +5°C. and —30°C. (+41°-—22°F.). It must have a reasonably broad temperature range before it reaches the boiling point, and it must have a fairly respectable molecular weight. In addition, when frozen it must appear white, it must be a reasonably stable compound, and while it must have a reasonable molecular weight it must also be capable of being held aloft while in a supercooled state if we are to account for occasional clouds seen in the atmosphere. Not too surprisingly, there are only a few substances which are even remotely feasible. In fact, the only competitor to water becomes nitrogen tetroxide.

With a molecular weight of 92.02, a freezing point of —9.3°C., and a vapor point at +21.3°C., oxides of nitrogen have been advanced as accounting for the polar caps and other distinctive phenomena. The arguments advanced for N_2O_4 are ingenious and to a certain extent rather convincing. It is pointed out that the albedo of the polar cap is only some 60% that of deep snow and that this coincides with the albedo of the chalky white N_2O_4. Additionally, a noteworthy deficiency of the reflected light of Mars in the blue and violet spectral regions is readily explainable in terms of an absorption of N_2O_4. The seasonal changes of color and texture around the equatorial regions are presumed to be instances of unspecified reversible reactions caused by the relatively unstable character of the various nitrogen oxides—which interconvert with changes of temperature or pressure. Finally, since the gaseous state of nitrogen tetroxide is reddish-brown, this is assumed to be a substitute for what have previously been interpreted as "sand storms" occasionally observed on the surface.

Despite some telling points here, the edge appears decisively in favor of water. The extensive melting of the polar cap during the summer months is conclusive evidence that it

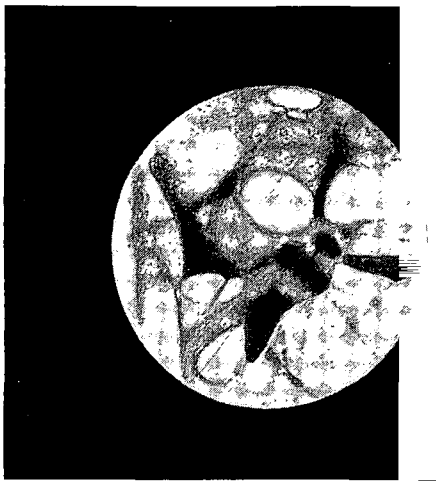

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Fig. 5: Sketch of predominant martian surface features. Note canal *fading into nothingness in the middle of white circular area in center of disk. Other* canali *and "oases" may be seen in lower right. Darker region between these two areas shows interesting pattern of five "oases."*

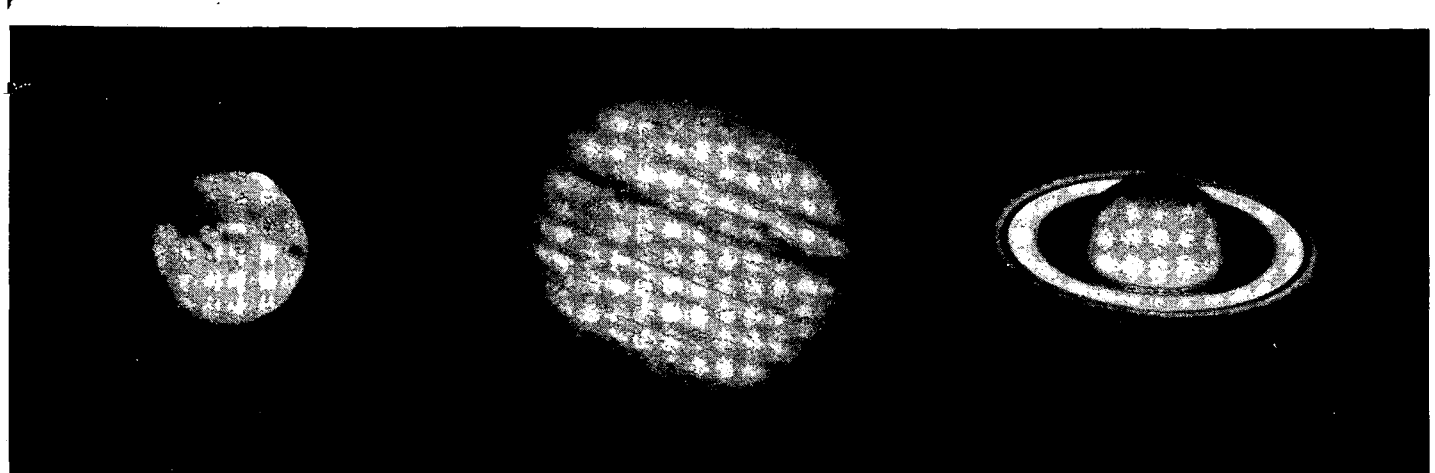

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Fig. 6: Comparative sizes of planetary disks (Mars, Jupiter, Saturn) as they appear to observer on Earth. The photograph of Mars is unusually clear.

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cannot be very thick. It is more likely to be in the nature of a deposit of rime ice of the type which occasionally leeches from clear air at temperatures as low as —51.1° (—60°F.). Under these circumstances we would find an albedo about 60% that of deep snow. Thus the argument from albedo supports either side.

The argument from absorption is similarly inconclusive. Nitrogen itself is somewhat absorptive in the violet range. Moreover, in earth's own atmosphere there is evidence of some oxides of nitrogen at high altitudes, but these are almost totally lacking at the surface. A similar situation may exist on Mars.

In terms of positive arguments against N_2O_4 and for H_2O, the matter becomes even more convincing. Since under any theory water must be extremely scarce, then as soon as we acknowledge an atmosphere and an exposed solid surface on Mars we imply a situation where, whether or not we have oxides of nitrogen, we will have dust storms. It is, therefore, superfluous to attempt to account for these storms in terms of N_2O_4. Even more to the point, in some instances reported cloud formations have been white. Nitrogen oxide cannot account for these; water vapor can.

When we stop to consider the atmospheric pressure over Mars it becomes evident that most of our problems are apparent rather than real. At a pressure of some 83 mm of mercury, that of Mars' surface, the boiling point of water is in the neighborhood of +45°, the precise figure depending upon the percentage of heavy isotopes of oxygen. The cloud formations which would ensue would almost inevitably consist of altocirrus and cirrocumulus types containing ice crystals and sublimation nuclei. The water content of such clouds is often negligible while the optical effects are surprisingly large. This type of cloud could easily be seen through a telescope while a simultaneous spectrograph would give inconclusive readings for water content. On the balance, therefore, we conclude that some small volume of water does exist on Mars. This being the case, we may further conclude that there are few, if any, unexpected chemical constituents in the atmosphere. The presence of even a moderate amount of water vapor would preclude virtually any exotic reactions.

Of the inert gases only argon represents any sort of a problem. In at least one instance it has been proposed as a major constituent of the martian atmosphere. This reasoning has been based on its usual atomic weight of 40—as contrasted with molecular oxygen's weight of 32 and a molecular nitrogen weight of 28—and on the fact that potassium-40, with a half life of 1.3×10^9 years, is an unstable isotope which decays into A-40 so that there is a constant, if small, replenishment of A-40 through the ages.

Using the earth as our point of comparison, we observe that the various isotopes of potassium comprise some 2.6% of the lithosphere. K-40, the principal unstable isotope, represents only .0119% of all potassium today existing. Assuming the earth to be 5.2×10^9 years old, this means the initial percentage of K-40 must have been in the vicinity of .0476. Assuming further that we need only consider the top kilometer of the lithosphere, this means that approximately 4774 km^3 of K-40 have been converted into A-40 over the ages. Since argon represents 0.93% of the atmosphere by volume it is evident that the majority of this argon is a direct product of the decay of K-40. Taking the earth as possessing fifteen times the surface area of Mars we discover that if the initial composition of Mars were substantially that of earth, a total of 316 km^3 of K-40 will have been converted into A-40. If none of this A-40 were lost through atmospheric seepage, then as much as fifteen per cent of the martian atmosphere might consist of argon. But this would be a tricky assumption since it would imply a rigidly stratified atmosphere. Under any other circumstances atmospheric seepage is a function of mass and on this basis we would expect five atoms of argon to be lost for every seven nitrogen molecules or six oxygen molecules. The percentage of argon, therefore, will probably not exceed seven per cent under the most favorable circumstances with the likelihood being that it ranges around five per cent.

In general, we may expect the martian atmosphere to consist of between 87-93% nitrogen. CO_2 probably does not constitute more than .1%. The heavier gases, argon, krypton and xenon probably comprise 6-8% while the lighter hydrogen, helium and neon will scarcely be found even in trace quantities. No more than another 5-7% could be apportioned to oxygen and ozone molecules. Suspended water vapor could hardly exceed .2% and probably is less than .05%.

Turning now to the question of the surface itself, Fig. 5 represents a reasonably noncommittal consensus of opinion of its character. By contrast, Fig. 6 represents an unusually clear photograph which may be used, along with the others, for comparison.

A logical first question to ask is whether or not we can expect the surface to comprise a vast plain, as is often hypothesized. Is there, for instance, any reason to expect the existence of tectonic changes and mountain building processes at any time during the martian history?

As in the question of atmospheric composition there are arguments on both sides. We have already observed the density to be only 70% that of earth, which implies the absence of a heavy inner core. Further,

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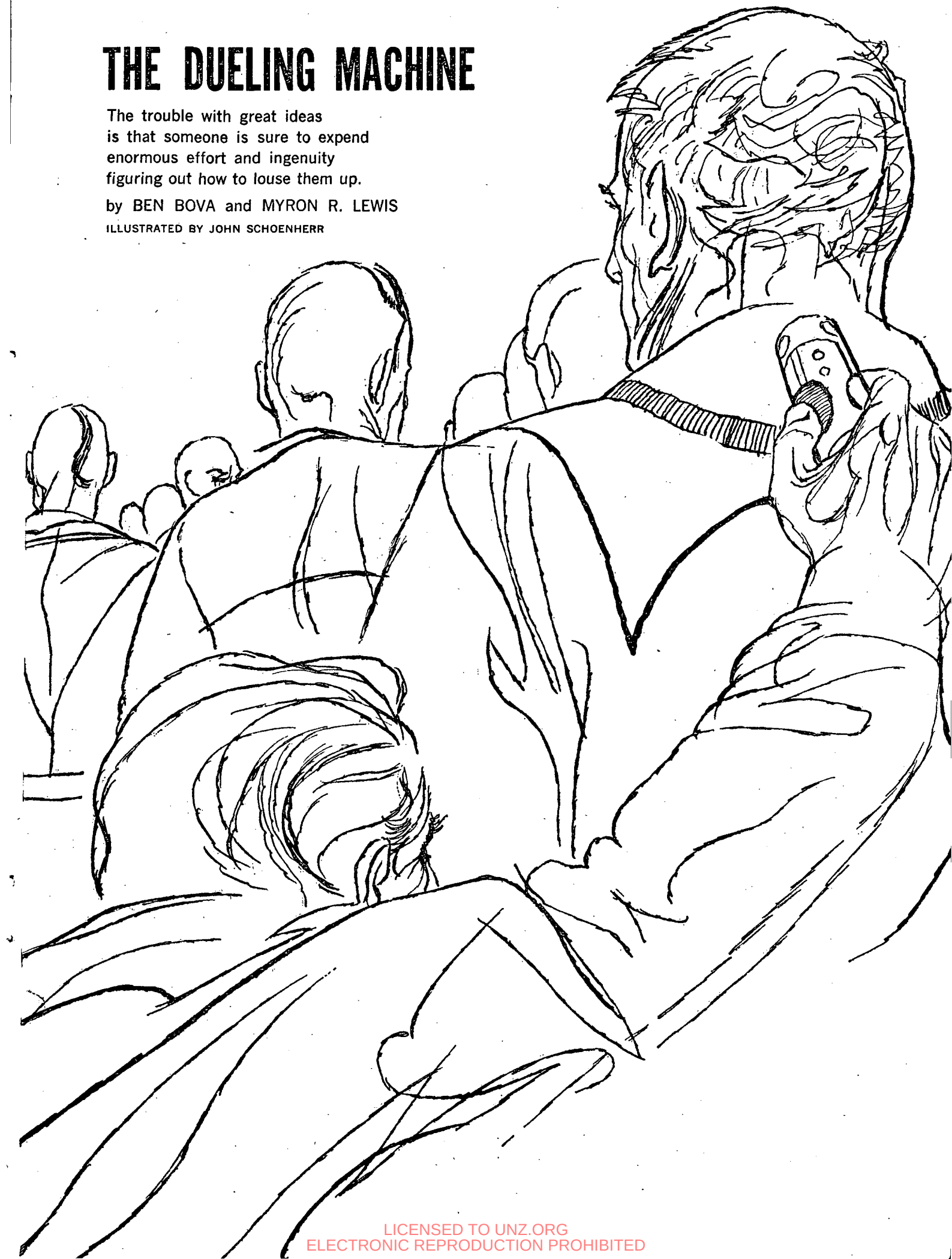
THE DUELING MACHINE

The trouble with great ideas
is that someone is sure to expend
enormous effort and ingenuity
figuring out how to louse them up.

by BEN BOVA and MYRON R. LEWIS

ILLUSTRATED BY JOHN SCHOENHERR



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Dulaq rode the slide to the upper pedestrian level, stepped off and walked over to the railing. The city stretched out all around him—broad avenues thronged with busy people, pedestrian walks, vehicle thoroughfares, aircars gliding between the gleaming, towering buildings.

And somewhere in this vast city was the man he must kill. The man who would kill him, perhaps.

It all seemed so real! The noise of the streets, the odors of the perfumed trees lining the walks, even the warmth of the reddish sun on his back as he scanned the scene before him.

It is an illusion, Dulaq reminded himself, *a clever man-made hallucination. A figment of my own imagination amplified by a machine.*

But it seemed so very real.

Real or not, he had to find Odal before the sun set. Find him and kill him. Those were the terms of the duel. He fingered the stubby cylinderical stat-wind in his tunic pocket. That was the weapon he had chosen, his weapon, his own invention. And this was the environment he had picked: his city, busy, noisy, crowded, the metropolis Dulaq had known and loved since childhood.

Dulaq turned and glanced at the sun. It was halfway down toward the horizon, he judged. He had about three hours to find Odal. When he did—kill or be killed.

Of course no one is actually hurt. That is the beauty of the machine. It allows one to settle a score, to work out aggressive feelings, without either mental or physical harm.

Dulaq shrugged. He was a roundish figure, moon-faced, slightly stooped shoulders. He had work to do. Unpleasant work for a civilized man, but the future of the Acquataine Cluster and the entire alliance of neighboring star systems could well depend on the outcome of this electronically synthesized dream.

He turned and walked down the elevated avenue, marveling at the sharp sensation of hardness that met each footstep on the paving. Children dashed by and rushed up to a toyshop window. Men of commerce strode along purposefully, but without missing a chance to eye the girls sauntering by.

I must have a marvelous imagination, Dulaq thought smiling to himself.

Then he thought of Odal, the blond, icy professional he was pitted against. Odal was an expert at all the weapons, a man of strength and cool precision, an emotionless tool in the hands of a ruthless politician. But how expert could he be with a stat-wand, when the first time he saw one was the moment before the duel began? And how well acquainted could he be with the metropolis, when he had spent most of his life in the military camps on the dreary planets of Kerak, sixty light-years from Acquatainia?

No, Odal would be lost and helpless in this situation. He would attempt to hide among the throngs of people. All Dulaq had to do was to find him.

The terms of the duel restricted both men to the pedestrian walks of the commercial quarter of the city. Dulaq knew the area intimately, and he began a methodical hunt through the crowds for the tall, fair-haired, blue-eyed Odal.

And he saw him! After only a few minutes of walking down the major thoroughfare, he spotted his opponent, strolling calmly along a crosswalk, at the level below.

Dulaq hurried down the next ramp, worked his way through the crowd, and saw the man again. Tall and blond, unmistakable. Dulaq edged along behind him quietly, easily. No disturbance. No pushing. Plenty of time. They walked along the street for a quarter hour while the distance between them slowly shrank from fifty feet to five.

Finally Dulaq was directly behind him, within arm's reach. He grasped the stat-wand and pulled it from his tunic. With one quick motion he touched it to the base of the man's skull and started to thumb the button that would release the killing bolt of energy . . .

The man turned suddenly. It wasn't Odal!

Dulaq jerked back in surprise. It couldn't be. He had seen his face. It was Odal—and yet this man was definitely a stranger.

He stared at Dulaq as the duelist backed away a few steps, then turned and walked quickly from the place.

A mistake, Dulaq told himself. *You were overanxious. A good thing this is an hallucination; or else the autopolice would be taking you in by now.*

And yet . . . he had been so certain that it was Odal. A chill shuddered through him. He looked up, and there was his antagonist, on the thoroughfare above, at the precise spot where he himself had been a few minutes earlier. Their eyes met, and Odal's lips parted in a cold smile.

Dulaq hurried up the ramp. Odal was gone by the time he reached the upper level. *He could not have gotten far,* Dulaq reasoned. Slowly, but very surely, Dulaq's hallucination turned into a nightmare. He spotted Odal in the crowd, only to have him melt away. He saw him again, lolling in a small park, but when he got closer, the man turned out to be another stranger. He felt the chill of the duelist's ice-blue eyes on him again and again, but when he turned to find his antagonist, no one was there but the impersonal crowd.

Odal's face appeared again and again. Dulaq struggled through the throngs to find his opponent, only to have him vanish. The crowd seemed to be filled with tall, blond men crisscrossing before Dulaq's dismayed eyes.

The shadows lengthened. The sun was setting. Dulaq could feel his heart pounding within him and perspiration pouring from every square inch of his skin.

There he is! Definitely, positively him! Dulaq pushed through the homeward-bound crowds toward the figure of a tall, blond man leaning againt the safety railing of the city's main thoroughfare. It was Odal, the damned smiling confident Odal.

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Dulaq pulled the wand from his tunic and battled across the surging crowd to the spot where Odal stood motionless, hands in pockets, watching him.

Dulaq came within arm's reach . . .

"TIME, GENTLEMEN. TIME IS UP, THE DUEL IS ENDED."

High above the floor of the antiseptic-white chamber that housed the dueling machine was a narrow gallery, Before the machine had been installed, the chamber had been a lecture hall in Acquatainia's largest university. Now the rows of students' seats, the lecturer's dais and rostrum were gone. The chamber held only the machine, the grotesque collection of consoles, control desks, power units, association circuits, and booths where the two antagonists sat.

In the gallery—empty during ordinary duels—sat a privileged handful of newsmen.

"Time limit is up," one of them said. "Dulaq didn't get him."

"Yes, but he didn't get Dulaq, either."

The first one shrugged. "The important thing is that now Dulaq has to fight Odal on *his* terms. Dulaq couldn't win with his own choice of weapons and situation, so—"

"Wait, they're coming out."

Down on the floor below, Dulaq and his opponent emerged from their enclosed booths.

One of the newsmen whistled softly. "Look at Dulaq's face . . . it's positively gray."

"I've never seen the Prime Minister so shaken."

"And take a look at Kanus' hired assassin." The newsmen turned toward Odal, who stood before his booth, quietly chatting with his seconds.

"Hm-m-m. There's a bucket of frozen ammonia for you."

"He's enjoying this."

One of the newsmen stood up. "I've got a deadline to meet. Save my seat."

He made his way past the guarded door, down the rampway circling the outer walls of the building, to the portable tri-di transmitting unit that the Acquatainian government had permitted for the newsmen on the campus grounds outside the former lecture hall.

The newsman huddled with his technicians for a few minutes, then stepped before the transmitter.

"Emile Dulaq, Prime Minister of the Acquataine Cluster and acknowledged leader of the coalition against Chancellor Kanus of the Kerak Worlds, has failed in the first part of his psychonic duel against Major Par Odal of Kerak. The two antagonists are now undergoing the routine medical and psychological checks before renewing their duel."

By the time the newsman returned to his gallery seat, the duel was almost ready to begin again.

Dulaq stood in the midist of a group of advisors before the looming impersonality of the machine.

"You need not go through with the next phase of the duel immediately," his Minister of Defense was saying. "Wait until tomorrow. Rest and calm yourself."

Dulaq's round face puckered into a frown. He cocked an eye at the chief meditech, hovering at the edge of the little group.

The meditech, one of the staff that ran the dueling machine, pointed out, "The Prime Minister has passed the examinations. He is capable, within the agreed-upon rules of the contest, of resuming."

"But he has the option of retiring for the day, does he not?"

"If Major Odal agrees."

Dulaq shook his head impatiently. "No. I shall go through with it. Now."

"But—"

The prime minister's face suddenly hardened; his advisors lapsed into a respectful silence. The chief meditech ushered Dulaq back into his booth. On the other side of the room, Odal glanced at the Acquatainians, grinned humorlessly, and strode to his own booth.

Dulaq sat and tried to blank out his mind while the meditechs adjusted the neurocontacts to his head and torso. They finished at last and withdrew. He was alone in the booth now, looking at the dead-white walls, completely bare except for the viewscreen before his eyes. The screen finally began to glow slightly, then brightened into a series of shifting colors. The colors merged and changed, swirled across his field of view. Dulaq felt himself being drawn into them gradually, compellingly, completely immersed in them.

The mists slowly vanished, and Dulaq found himself standing on an immense and totally barren plain. Not a tree, not a blade of grass; nothing but bare, rocky ground stretching in all directions to the horizon and disturbingly harsh yellow sky. He looked down and at his feet saw the weapon that Odal had chosen.

A primitive club.

With a sense of dread, Dulaq picked up the club and hefted it in his hand. He scanned the plain. Nothing. No hills or trees or bushes to hide in. No place to run to.

And off on the horizon he could see a tall, lithe figure holding a similar club walking slowly and deliberately toward him.

The press gallery was practically empty. The duel had more than an hour to run, and most of the newsmen were outside, broadcasting their hastily-drawn guesses about Dulaq's failure to win with his own choice of weapon and environment.

Then a curious thing happened.

On the master control panel of the dueling machine, a single light flashed red. The meditech blinked at it in surprise, then pressed a series of buttons on his board. More red lights appeared. The chief meditech rushed to the board and flipped a single switch.

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One of the newsmen turned to his partner. "What's going on down there?"

"I think it's all over . . . Yes, look, they're opening up the booths. Somebody must've scored a victory."

They watched intently while the other newsmen quickly filed back into the gallery.

"There's Odal. He looks happy."

"Guess that means—"

"Good Lord! Look at Dulaq!"

II

Dr. Leoh was lecturing at the Carinae Regional University when the news of Dulaq's duel reached him. An assistant professor perpetrated the unthinkable breach of interrupting the lecture to whisper the news in his ear.

Leoh nodded grimly, hurriedly finished his lecture, and then accompanied the assistant professor to the University president's office. They stood in silence as the slideway whisked them through the strolling students and blossoming greenery of the quietly-busy campus.

Leoh remained wrapped in his thoughts as they entered the administration building and rode the lift tube. Finally, as they stepped through the president's doorway, Leoh asked the assistant professor:

"You say he was in a state of catatonic shock when they removed him from the machine?"

"He still is," the president answered from his desk. "Completely withdrawn from the real world. Cannot speak, hear, or even see—a living vegetable."

Leoh plopped down in the nearest chair and ran a hand across his fleshy face. He was balding and jowly, but his face was creased from a smile that was almost habitual, and his eyes were active and alert.

"I don't understand it," he admitted. "Nothing like this has ever happened in a dueling machine before."

The university president shrugged. "I don't understand it either. But, this is your business." He put a slight emphasis on the last word, unconsciously perhaps.

"Well, at least this will not reflect on the university. That is why I formed Psychonics as a separate business enterprise." Then he added, with a grin, "The money was, of course, only a secondary consideration."

The president managed a smile. "Of course."

"I suppose the Acquatainians want to see me?" Leoh asked academically.

"They're on the tri-di now, waiting for you."

"They're holding a transmission frequency open over eight hundred parsecs?" Leoh looked impressed. "I must be an important man."

"You're the inventor of the dueling machine and the head of Psychonics, Inc. You're the only man who can tell them what went wrong."

"Well, I suppose I shouldn't keep them waiting."

"You can take the call here," the president said, starting to get up from his chair.

"No, no, stay there at your desk," Leoh insisted. "There's no reason for you to leave. Or you either," he said to the assistant professor.

The president touched a button on his desk communicator. The far wall of the office glowed momentarily, then seemed to dissolve. They were looking into another office, this one on Acquatainia. It was crowded with nervous-looking men in business clothes and military uniforms.

"Gentlemen," Dr. Leoh said.

Several of the Acquatainians tried to answer him at once. After a few seconds of talking together, they all looked toward one of their members—a tall, purposeful, shrewd-faced civilian who bore a neatly-trimmed black beard.

"I am Fernd Massan, the Acting Prime Minister of Acquatainia. You realize, of course, the crisis that has been precipitated in my Government because of this duel?"

Leoh blinked. "I realize that apparently there has been some difficulty with the dueling machine installed on the governing planet of your star cluster. Political crises are not in my field."

"But your dueling machine has incapacitated the Prime Minister," one of the generals bellowed.

"And at this particular moment," the defense minister added, "in the midst of our difficulties with the Kerak Worlds."

"If the Prime Minister is not—"

"Gentlemen!" Leoh objected. "I cannot make sense of your story if you all speak at once."

Massan gestured them to silence.

"The dueling machine," Leoh said, adopting a slightly professorial tone, "is nothing more than a psychonic device for alleviating human aggressions and hostilities. It allows two men to share a dream world created by one of them. There is nearly-complete feedback between the two. Within certain limits, the two men can do anything they wish within their dream world. This allows men to settle grievances with violence—in the safety of their own imaginations. If the machine is operated properly, no physical or mental harm can be done to the participants. They can alleviate their tensions safely—without damage of any sort to anyone, and without hurting society.

"Your own Government tested one of the machines and approved its use on Acquatainia more than three years ago. I see several of you who were among those to whom I personally demonstrated the device. Dueling machines are in use through wide portions of the galaxy, and I am certain that many of you have used the machine. You have, general, I'm sure."

The general blustered. "That has nothing to do with the matter at hand!"

"Admittedly," Leoh conceded. "But I do not understand how a therapeutic machine can possibly become entangled in a political crisis."

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Massan said; "Allow me to explain. Our Government has been conducting extremely delicate negotiations with the stellar governments of our neighboring territories. These negotiations concern the rearmaments of the Kerak Worlds. You have heard of Kanus of Kerak?"

"I recall the name vaguely," Leoh said. "He's a political leader of some sort."

"Of the worst sort. He has acquired complete dictatorship of the Kerak Worlds, and is now attempting to rearm them for war. This is in direct countervention of the Treaty of Acquatainia, signed only thirty Terran years ago."

"I see. The treaty was signed at the end of the Acquataine-Kerak war, wasn't it?"

"A war that we won," the general pointed out.

"And now the Kerak Worlds want to rearm and try again," Leoh said.

"Precisely."

Leoh shrugged. "Why not call in the Star Watch? This is their type of police activity. And what has all this to do with the dueling machine?"

Massan explained patiently, "The Acquataine Cluster has never become a full-fledged member of the Terran Commonwealth. Our neighboring territories are likewise unaffiliated. Therefore the Star Watch can intervene only if all parties concerned agree to intervention. Unless, of course, there is an actual military emergency. The Kerak Worlds, of course, are completely isolationist—unbound by any laws except those of force."

Leoh shook his head.

"As for the dueling machine," Massan went on, "Kanus of Kerak has turned it into a political weapon—"

"But that's impossible. Your government passed strict laws concerning the use of the machine; I recommended them and I was in your Council chambers when the laws were passed. The machine may be used only for personal grievances. It is strictly outside the realm of politics."

Massan shook his head sadly. "Sir, laws are one thing—people are another. And politics consists of people, not words on paper."

"I don't understand," Leoh said.

Massan explained, "A little more than one Terran year ago, Kanus picked a quarrel with a neighboring star-group—the Safad Federation. He wanted an especially favorable trade agreement with them. Their minister of trade objected most strenuously. One of the Kerak negotiators—a certain Major Odal—got into a personal argument with the minister. Before anyone knew what had happened, they had challenged each other to a duel. Odal won the duel, and the minister resigned his post. He said that he could no longer effectively fight against the will of Odal and his group . . . he

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was psychologically incapable of it. Two weeks later he was dead—apparently a suicide, although I have doubts."

"That's . . . extremely interesting," Leoh said.

"Three days ago," Massan continued, "the same Major Odal engaged Prime Minister Dulaq in a bitter personal argument. Odal is now a military attaché of the Kerak Embassy here. He accused the Prime Minister of cowardice, before a large group at an Embassy party. The Prime Minister had no alternative but to challenge him. And now—"

"And now Dulaq is in a state of shock, and your government is tottering."

Massan's back stiffened. "Our Government shall not fall, nor shall the Acquataine Cluster acquiesce to the rearmament of the Kerak Worlds. But"—his voice lowered—"without Dulaq, I fear that our neighboring governments will give in to Kanus' demands and allow him to rearm. Alone, we are powerless to stop him."

"Rearmament itself might not be so bad," Leoh mused, "if you can keep the Kerak Worlds from using their weapons. Perhaps the Star Watch might—"

"Kanus could strike a blow and conquer a star system before the Star Watch could be summoned and arrive to stop him. Once Kerak is armed, this entire area of the galaxy is in peril. In fact, the entire galaxy is endangered."

"And he's using the dueling machine to further his ambitions," Leoh said. "Well, gentlemen, it seems I have no alternative but to travel to the Acquataine Cluster. The dueling machine is my responsibility, and if, there is something wrong with it, or with the use of it, I will do my best to correct the situation."

"That is all we ask," Massan said. "Thank you."

The Acquatainian scene faded away, and the three men in the university president's office found themselves looking at a solid wall once again.

"Well," Dr. Leoh said, turning to the president, "it seems that I must request an indefinite leave of absence."

The president frowned. "And it seems that I must grant your request—even though the year is only half-finished."

"I regret the necessity," Leoh said; then, with a broad grin, he added, "My assistant professor, here, can handle my courses for the remainder of the year very easily. Perhaps he will even be able to deliver his lectures without being interrupted."

The assistant professor turned red.

"Now then," Leoh muttered, mostly to himself, "who is this Kanus, and why is he trying to turn the Kerak Worlds into an arsenal?"

III

Chancellor Kanus, the supreme leader of the Kerak Worlds, stood at the edge of the balcony and looked across the wild, tumbling gorge to the rugged mountains beyond.

"These are the forces that mold men's actions," he said to his small audience of officials and advisors, "the howling winds, the mighty mountains, the open sky and the dark powers of the clouds."

The men nodded and made murmurs of agreement.

"Just as the mountains thrust up from the pettiness of the lands below, so shall we rise above the common walk of men," Kanus said. "Just as a thunderstorm terrifies them, we will make them bend to our will!"

"We will destroy the past," said one of the ministers.

"And avenge the memory of defeat," Kanus added. He turned and looked at the little group of men. Kanus was the smallest man on the balcony: short, spare, sallow-faced; but he possessed piercing dark eyes and a strong voice that commanded attention.

He walked through the knot of men and stopped before a tall, lean, blond youth in light-blue military uniform. "And you, Major Odal, will be a primary instrument in the first steps of conquest."

Odal bowed stiffly. "I only hope to serve my leader and my worlds."

"You shall. And you already have," Kanus said, beaming. "Already the Acquatainians are thrashing about like a snake whose head has been cut off. Without Dulaq, they have no head, no brain to direct them. For your part in this triumph"—Kanus snapped his fingers, and one of his advisors quickly stepped to his side and handed him a small ebony box—"I present you with this token of the esteem of the Kerak Worlds, and of my personal high regard."

He handed the box to Odal, who opened it and took out a small jeweled pin.

"The Star of Kerak," Kanus announced. "This is the first time it has been awarded to anyone except a warrior on the battlefield. But then, we have turned their so-called civilized machine into our own battlefield eh?"

Odal grinned. "Yes, sir, we have. Thank you very much sir. This is the supreme moment of my life."

"To date, major. Only to date. There will be other moments, even higher ones. Come, let's go inside. We have many plans to discuss . . . more duels . . . more triumphs."

They all filed in to Kanus' huge, elaborate office. The leader walked across the plushly ornate room and sat at the elevated desk, while his followers arranged themselves in the chairs and couches placed about the floor. Odal remained standing, near the doorway.

Kanus let his fingers flick across a small control board set into his desktop, and a tri-dimensional star map glowed into existence on the far wall. As its center were the eleven stars that harbored the Kerak Worlds. Around them stood neighboring stars, color-coded to show their political groupings. Off to one side of the map was the Acquataine Cluster, a rich mass of stars—wealthy, powerful, the most important political and economic power in the section of the galaxy. Until yesterday's duel.

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Kanus began one of his inevitable harangues. Objectives, political and military. Already the Kerak Worlds were unified under his dominant will. The people would follow wherever he led. Already the political alliances built up by Acquatainian diplomacy since the last war were tottering, now that Dulaq was out of the picture. Now was the time to strike. A political blow *here,* at the Szarno Confederacy, to bring them and their armaments industries into line with Kerak. Then more political strikes to isolate the Acquataine Cluster from its allies, and to build up subservient states for Kerak. Then, finally, the military blow—against the Acquatainians.

"A sudden strike, a quick, decisive series of blows, and the Acquatainians will collapse like a house of paper. Before the Star Watch can interfere, we will be masters of the Cluster. Then, with the resources of Acquatainia to draw on, we can challenge any force in the galaxy—even the Terran Commonwealth itself!"

The men in the room nodded their assent.

They've heard this story many, many times, Odal thought to himself. This was the first time he had been privileged to listen to it. If you closed your eyes, or looked only at the star map, the plan sounded bizarre, extreme, even impossible. But, if you watched Kanus, and let those piercing, almost hypnotic eyes fasten on yours, then the leader's wildest dreams sounded not only exciting, but inevitable.

Odal leaned a shoulder against the paneled wall and scanned the other men in the room.

There was fat Greber, the vice chancellor, fighting desperately to stay awake after drinking too much wine during the luncheon and afterward. And Modal, sitting on the couch next to him, was bright-eyed and alert, thinking only of how much money and power would come to him as Chief of Industries once the rearmament program began in earnest.

Sitting alone on another couch was Kor, the quiet one, the head of Intelligence, and—technically—Odal's superior. Silent Kor, whose few words were usually charged with terror for those whom he spoke against.

Marshal Lugal looked bored when Kanus spoke of politics, but his face changed when military matters came up. The marshal lived for only one purpose; to avenge his army's humiliating defeat in the war against the Acquatainians, thirty Terran years ago. What he didn't realize, Odal thought, smiling to himself, was that as soon as he had reorganized the army and re-equipped it, Kanus planned to retire him and place younger men in charge. Men whose only loyalty was not to the army, nor even to the Kerak Worlds and their people, but to the chancellor himself.

Eagerly following every syllable, every gesture of the leader was little Tinth. Born to the nobility, trained in the arts, a student of philosophy, Tinth had deserted his heritage and joined the forces of Kanus. His reward had been the Ministry of Education; many teachers had suffered under him.

And finally there was Romis, the Minister of Intergovernmental Affairs. A professional diplomat, and one of the few men in government before Kanus' sweep to power to survive this long. It was clear that Romis hated the chancellor. But he served the Kerak Worlds well. The diplomatic corps was flawless in their handling of intergovernmental affairs. It was only a matter of time, Odal knew, before one of them—Romis or Kanus—killed the other.

The rest of Kanus' audience consisted of political hacks, roughnecks-turned-bodyguards, and a few other hangers-on who had been with Kanus since the days when he held his political monologues in cellars, and haunted the alleys to avoid the police. Kanus had come a long way: from the blackness of oblivion to the dazzling heights of the chancellor's rural estate.

Money, power, glory, revenge, patriotism: each man in the room, listening to Kanus, had his reasons for following the chancellor.

And my reasons? Odal asked himself. *Why do I follow him? Can I see into my own mind as easily as I see into theirs?*

There was duty, of course. Odal was a soldier, and Kanus was the duly-elected leader of the government. Once elected, though, he had dissolved the government and solidified his powers as absolute dictator of the Kerak Worlds.

There was gain to be had by performing well under Kanus. Regardless of his political ambitions and personal tyrannies, Kanus rewarded well when he was pleased. The medal—the Star of Kerak—carried with it an annual pension that would nicely accommodate a family. *If I had one,* Odal thought, sardonically.

There was power, of sorts, also. Working the dueling machine in his special way, hammering a man into nothingness, finding the weaknesses in his personality and exploiting them, pitting his mind against others, turning sneering towers of pride like Dulaq into helpless whipped dogs—that was power. And it was a power that did not go unnoticed in the cities of the Kerak Worlds. Already Odal was easily recognized on the streets; women especially seemed to be attracted to him now.

"The most important factor," Kanus was saying, "and I cannot stress it overmuch, is to build up an aura of invincibility. This is why your work is so important, Major Odal. You must be invincible! Because today you represent the collective will of the Kerak Worlds. Today you are the instrument of my own will—and you must triumph at every turn. The fate of your people, of your government, of your chancellor rests squarely on your shoulders each time you step into a dueling machine. You have borne that responsibility well, major. Can you carry it even further?"

"I can, sir," Odal answered crisply," and I will."

Kanus beamed at him. "Good! Because your next duel —and those that follow it—will be to the death."

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IV

It took the starship two weeks to make the journey from Carinae to the Acquataine Cluster. Dr. Leoh spent the time checking over the Acquatainian dueling machine, by direct tri-di beam; the Acquatainian government gave him all the technicians, time and money he needed for the task.

Leoh spent as much of his spare time as possible with the other passengers of the ship. He was gregarious, a fine conversationalist, and had a nicely-balanced sense of humor. Particularly, he was a favorite of the younger women, since he had reached the age where he could flatter them with his attention without making them feel endangered.

But still, there were long hours when he was alone in his stateroom with nothing but his memories. At times like these, it was impossible not to think back over the road he had been following.

Albert Robertus Leoh, Ph.D., Professor of Physics, Professor of Electronics, master of computer technology, inventor of the interstellar tri-di communications system; and more recently, student of psychology, Professor of Psychophysiology, founder of Psychonics, Inc., inventor of the dueling machine.

During his earlier years, when the supreme confidence of youth was still with him, Leoh had envisioned himself as helping mankind to spread his colonies and civilizations throughout the galaxy. The bitter years of galactic war had ended in his childhood, and now human societies throughout the Milky Way were linked together —in greater or lesser degree of union—into a more-or-less peaceful coalition of star groups.

There were two great motivating forces at work on those human societies spread across the stars, and these forces worked toward opposite goals. On the one hand was the urge to explore, to reach new stars, new planets, to expand the frontiers of man's civilizations and found new colonies, new nations. Pitted against this drive to expand was an equally-powerful force: the realization that technology had finally put an end to physical labor and almost to poverty itself on all the civilized worlds of man. The urge to move off to the frontier was penned in and buried alive under the enervating comforts of civilization.

The result was inescapable. The civilized worlds became constantly more crowded as time wore on. They became jampacked islands of humanity sprinkled thinly across the sea of space that was still full of unpopulated islands.

The expense and difficulty of interstellar travel was often cited as an excuse. The starships *were* expensive: their power demands were frightful. Only the most determined—and the best financed—groups of colonists could afford them. The rest of mankind accepted the ease and safety of civilization, lived in the bulging cities of the teeming planets. Their lives were circumscribed by their neighbors, and by their governments. Constantly more people crowding into a fixed living space meant constantly less freedom. The freedom to dream, to run free, to procreate, all became state-owned, state-controlled monopolies.

And Leoh had contributed to this situation.

He had contributed his thoughts and his work. He had contributed often and regularly—the interstellar communications systems was only the one outstanding achievement in a long career of achievements.

Leoh had been nearly at the voluntary retirement age for scientists when he realized what he, and his fellow scientists, had done. Their efforts to make life richer and more rewarding for mankind had made life only less strenuous and more rigid.

And with every increase in comfort, Leoh discovered, came a corresponding increase in neuroses, in crimes of violence, in mental abberations. Senseless wars of pride broke out between star-groups for the first time in generations. Outwardly, the peace of the galaxy was assured; but beneath the glossy surface of the Terran Commonwealth there smoldered the beginnings of a volcano. Police actions fought by the Star Watch were increasing ominously. Petty wars between once-stable peoples were flaring up steadily.

Once Leoh realized the part he had played in this increasingly-tragic drama, he was confronted with two emotions—a deep sense of guilt, both personal and professional; and, countering this, a determination to do something, anything, to restore at least some balance to man's collective mentality.

Leoh stepped out of physics and electronics, and entered the field of psychology. Instead of retiring, he applied for a beginner's status in his new profession. It had taken considerable bending and straining of the Commonwealth's rules—but for a man of Leoh's stature, the rules could be flexed somewhat. Leoh became a student once again, then a researcher, and finally a Professor of Psychophysiology.

Out of this came the dueling machine. A combination of electroencephalograph and autocomputer. A dream machine, that amplified a man's imagination until he could engulf himself into a world of his own making.

Leoh envisioned it as a device to enable men to rid themselves of hostility and tension safety. Through his efforts, and those of his colleagues, dueling machines were quickly becoming accepted as devices for settling disputes.

When two men had a severe difference of opinion—deep enough to warrant legal action—they could go to the dueling machine instead of the courts. Instead of sitting helplessly and watching the machinations of the law grind impersonally through their differences, the two antagonists could allow their imaginations free rein in the dueling machine. They could settle their differences personally, as violently as they wished, without

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hurting themselves or anyone else. On most civilized worlds, the results of properly-monitored duels were accepted as legally binding.

The tensions of civilized life could be escaped—albeit temporarily—in the dueling machine. This was a powerful tool, much too powerful to allow it to be used indiscriminately. Therefore Leoh safeguarded his invention by forming a private company—Psychonics, Inc.—and securing an exclusive license from the Terran Commonwealth to manufacture, sell, install and maintain the machines. His customers were government health and legal agencies; his responsibilities were: legally, to the Commonwealth; morally, to all mankind; and, finally, to his own restless conscience.

The dueling machines succeeded. They worked as well, and often better, than Leoh had anticipated. But he knew that they were only a stopgap, only a temporary shoring of a constantly-eroding dam. What was needed, really needed, was some method of exploding the status quo, some means of convincing people to reach out for those unoccupied, unexplored stars that filled the galaxy, some way of convincing men that they should leave the comforts of civilization for the excitement of colonization.

Leoh had been searching for that method when the news of Dulaq's duel against Odal reached him.

Now he was speeding across parsecs of space, praying to himself that the dueling machine had not failed.

The two-week flight ended. The starship took up a parking orbit around the capital planet of the Acquataine Cluster. The passengers transhipped to the surface.

Dr. Leoh was met at the landing disk by an official delegation, headed by Massan, the acting prime minister. They exchanged formal greetings there at the base of the ship, while the other passengers hurried by.

As Leoh and Massan, surrounded by the other members of the delegation, rode the slideway to the port's administration building, Leoh commented:

"As you probably know, I have checked through your dueling machine quite thoroughly via tri-di for the past two weeks. I can find nothing wrong with it."

Massan shrugged. "Perhaps you should have checked then, the machine on Szarno."

"The Szarno Confederation? Their dueling machine?"

"Yes. This morning Kanus' hired assassin killed a man in it."

"He won another duel," Leoh said.

"You do not understand," Massan said grimly. "Major Odal's opponent—an industrialist who had spoken out against Kanus—was actually killed in the dueling machine. The man is dead!"

V

One of the advantages of being Commander-in-Chief of the Star Watch, the old man thought to himself, is that you can visit any planet in the Commonwealth.

He stood at the top of the hill and looked out over the green tableland of Kenya. This was the land of his birth, Earth was his homeworld. The Star Watch's official headquarters may be in the heart of a globular cluster of stars near the center of the galaxy, but Earth was the place the commander wanted most to see as he grew older and wearier.

An aide, who had been following the commander at a respectful distance, suddenly intruded himself in the old man's reverie.

"Sir, a message for you."

The commander scowled at the young officer. "I gave orders that I was not to be disturbed."

The officer, slim and stiff in his black-and-silver uniform, replied, "Your chief of staff has passed the message on to you, sir. It's from Dr. Leoh, of Carinae University. Personal and urgent, sir."

The old man grumbled to himself, but nodded. The aide placed a small crystalline sphere on the grass before him. The air above the sphere started to vibrate and glow.

"Sir Harold Spencer here," the commander said.

The bubbling air seemed to draw in on itself and take solid form. Dr. Leoh sat at a desk chair and looked up at the standing commander.

"Harold, it's a pleasure to see you once again."

Spencer's stern eyes softened, and his beefy face broke into a well-creased smile. "Albert, you ancient scoundrel. What do you mean by interrupting my first visit home in fifteen years?"

"It won't be a long interruption," Leoh said.

"You told my chief of staff that it was urgent," Sir Harold groused.

"It is. But it's not the sort of problem that requires much action on your part. Yet. You are familiar with recent political developments on the Kerak Worlds?"

Spencer snorted. "I know that a barbarian named Kanus has established himself as a dictator. He's a troublemaker. I've been talking to the Commonwealth Council about the advisability of quashing him before he causes grief, but you know the Council . . . first wait until the flames have sprung up, then thrash about and demand that the Star Watch do something!"

Leoh grinned. "You're as irascible as ever."

"My personality is not the subject of this rather expensive discussion. What about Kanus? And what are you doing, getting yourself involved in politics? About to change your profession again?"

"No, not at all," Leoh answered, laughing. Then, more seriously, "It seems as though Kanus has discovered some method of using the dueling machines to achieve political advantages over his neighbors."

"What?"

Leoh explained the circumstances of Odal's duels with the Acquatainian prime minister and Szarno industrialist.

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"Dulaq is completely incapacitated and the other poor fellow is dead?" Spencer's face darkened into a thundercloud. "You were right to call me. This is a situation that could easily become intolerable."

"I agree," Leoh said. "But evidently Kanus has not broken any laws or interstellar agreements. All that meets the eye is a disturbing pair of accidents, both of them accruing to Kanus' benefit."

"Do *you* believe that they were accidents?"

"Certainly not. The dueling machine cannot cause physical or mental harm . . . unless someone has tampered with it in some way."

"That is my thought, too." Spencer was silent for a moment, weighing the matter in his mind. "Very well. The Star Watch cannot act officially, but there is nothing to prevent me from dispatching an officer to the Acquataine Cluster, on detached duty, to serve as liaison between us."

"Good. I think that will be the most effective method of handling the situation, at present."

"It will be done," Sir Harold pronounced. His aide made a mental note of it.

"Thank you very much," Leoh said. "Now, go back to enjoying your vacation."

"Vacation? This is no vacation," Spencer rumbled. "I happen to be celebrating my birthday."

"So? Well, congratulations. I try not to remember mine," Leoh said.

"Then you must be older than I," Spencer replied, allowing only the faintest hint of a smile to appear.

"I suppose it's possible."

"But not very likely, eh?"

They laughed together and said good-by. The Star Watch commander tramped through the hills until sunset, enjoying the sight of the grasslands and distant purple mountains he had known in his childhood. As dusk closed in, he told his aide he was ready to leave.

The aide pressed a stud on his belt and a two-place aircar skimmed silently from the far side of the hills and hovered beside them. Spencer climbed in laboriously while the aide remained discreetly at his side. While the commander settled his bulk into his seat the aide hurried around the car and hopped into his place. The car glided off toward Spencer's personal planetship, waiting for him at a nearby field.

"Don't forget to assign an officer to Dr. Leoh," the commander muttered to his aide. Then he turned and watched the unmatchable beauty of an Earthly sunset.

The aide did not forget the assignment. That night, as Sir Harold's ship spiraled out to a rendezvous with a starship, the aide dictated the necessary order into an autodispatcher that immediately beamed it to the Star Watch's nearest communications center, on Mars.

The order was scanned and routed automatically and finally beamed to the Star Watch unit commandant in charge of the area closest to the Acquataine Cluster, on the sixth planet circling the star Perseus Alpha. Here again, the order was processed automatically and routed through the local headquarters to the personnel files. The automated files selected three microcard dossiers that matched the requirements of the order.

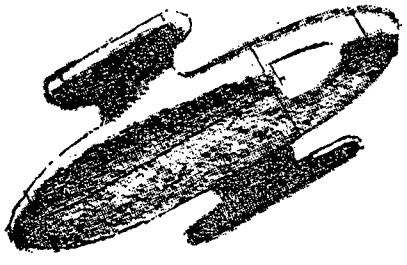
The three microcards and the order itself appeared simultaneously on the desktop viewer of the Star Watch personnel officer. He looked at the order, then read the dossiers. He flicked a button that gave him an updated status report on each of the three men in question. One was due for leave after an extensive period of duty. The second was the son of a personal friend of the local commandant. The third had just arrived a few weeks ago, fresh from the Star Watch Academy on Mars.

The personnel officer selected the third man, routed his dossier and Sir Harold's order back into the automatic processing system, and returned to the film of primitive dancing girls he had been watching before this matter of decision had arrived at his desk.

VI

The space station orbiting around Acquatainia—the capital planet of the Acquataine Cluster—served simultaneously as a transfer point from starships to planetships, a tourist resort, meteorological station, communications center, scientific laboratory, astronomical observatory, medical haven for allergy and cardiac patients, and military base. It was, in reality, a good-sized city with its own markets, its own local goverment, and its own way of life.

Dr. Leoh had just stepped off the debarking ramp of the starship from Szarno. The trip there had been pointless and fruitless. But he had gone anyway, in the slim



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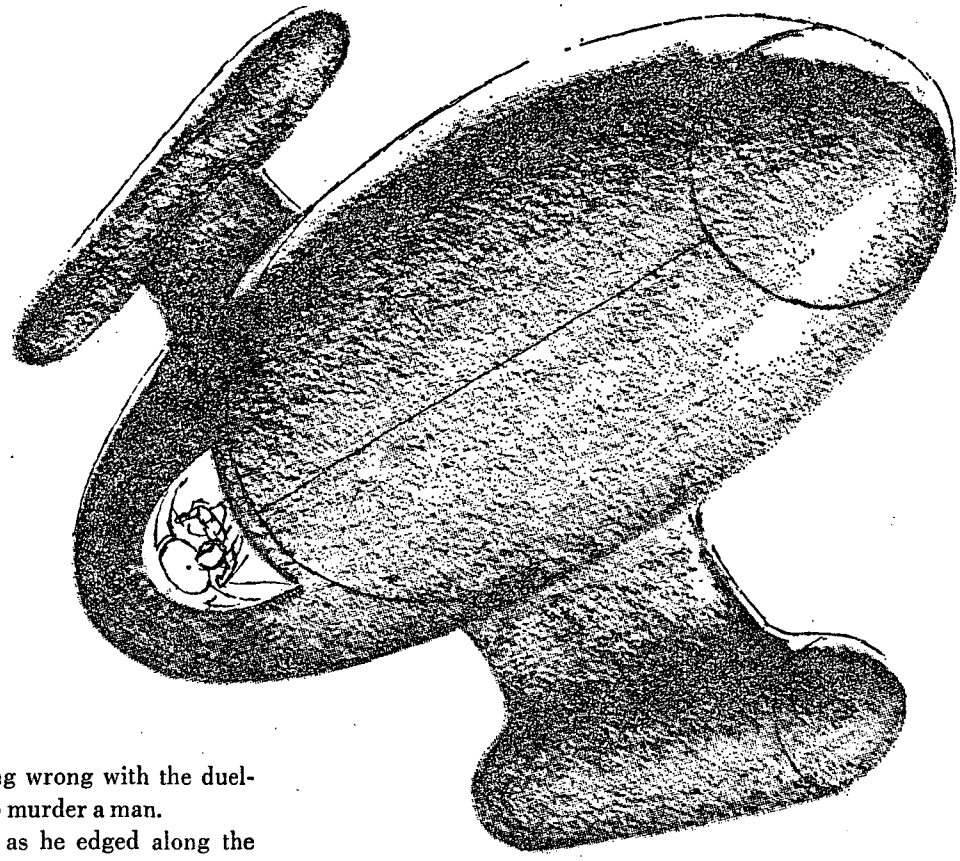

hope that he might find something wrong with the dueling machine that had been used to murder a man.

A shudder went through him as he edged along the automated customs scanners and paper-checkers. What kind of people could these men of Kerak be? To actually kill a human being in cold blood; to plot and plan the death of a fellow man. Worse than barbaric. Savage.

He felt tired as he left customs and took the slideway to the planetary shuttle ships. Halfway there, he decided to check at the communications desk for messages. That Star Watch officer that Sir Harold had promised him a week ago should have arrived by now.

The communications desk consisted of a small booth that contained the output printer of a communications computer and an attractive young dark-haired girl. Automation or not, Leoh thought smilingly, there were certain human values that transcended mere efficiency.

A lanky, thin-faced youth was half-leaning on the booth's counter, trying to talk to the girl. He had curly blond hair and crystal blue eyes; his clothes consisted of an ill-fitting pair of slacks and tunic. A small traveler's kit rested on the floor at his feet.

"So, I was sort of, well, thinking . . . maybe somebody might, uh, show me around . . . a little," he was stammering to the girl. "I've never been, uh, here . . ."

"It's the most beautiful planet in the galaxy," the girl was saying. "Its cities are the finest."

"Yes . . . well, I was sort of thinking . . . that is, I know we just, uh, met a few minutes ago . . . but, well, maybe . . . if you have a free day or so coming up . . . maybe we could, uh, sort of—"

She smiled coolly. "I have two days off at the end of the week, but I'll be staying here at the station. There's so much to see and do here, I very seldom leave."

"Oh—"

"You're making a mistake," Leoh interjected dogmatically. "If you have such a beautiful planet for your homeworld, why in the name of the gods of intellect don't you go down there and enjoy it? I'll wager you haven't been out in the natural beauty and fine cities you spoke of since you started working here on the station."

"Why, you're right," she said, surprised.

"You see? You youngsters are all alike. You never think further than the ends of your noses. You should return to the planet, young lady, and see the sunshine again. Why don't you visit the University at the capital city? Plenty of open space and greenery, lots of sunshine and available young men!"

Leoh was grinning broadly, and the girl smiled back at him. "Perhaps I will," she said.

"Ask for me when you get to the University. I'm Dr. Leoh. I'll see to it that you're introduced to some of the girls and gentlemen of your own age."

"Why . . . thank you, doctor. I'll do it this week end."

"Good. Now then, any messages for me? Anyone aboard the station looking for me?"

The girl turned and tapped a few keys on the computer's control console. A row of lights flicked briefly across the consol's face. She turned back to Leoh:

"No, sir, I'm sorry. No messages and no one has asked for you."

"Hm-m-m. That's strange. Well, thank you . . . and I'll expect to see you at the end of this week."

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The girl smiled a farewell. Leoh started to walk away from the booth, back toward the slideway. The young man took a step toward him, stumbled on his own traveling kit, and staggered across the floor for a half-dozen steps before regaining his balance. Leoh turned and saw that the youth's face bore a somewhat ridiculous expression of mixed indecision and curiosity.

"Can I help you?" Leoh asked, stopping at the edge of the moving slideway.

"How . . . how did you do that, sir?"

"Do what?"

"Get that girl to agree to visit the university. I've been talking to her for half an hour, and, well, she wouldn't even look straight at me."

Leoh broke into a chuckle. "Well, young man, to begin with, you were much too flustered. It made you appear overanxious. On the other hand, I am at an age where I can be strictly platonic. She was on guard against you, but she knows she has very little to fear from me."

"I see . . . I think."

"Well," Leoh said, gesturing toward the slideway, "I suppose this is where we go our separate ways."

"Oh, no, sir. I'm going with you. That is, I mean, you *are* Dr. Leoh, aren't you?"

"Yes, I am. And you must be—" Leoh hesitated. *Can this be a Star Watch officer?* he wondered.

The youth stiffened to attention and for an absurd flash of a second, Leoh thought he was going to salute. "I am Junior Lieutenant Hector, sir; on special detached duty from the cruiser SW4-J188, home base Perseus Alpha VI."

"I see," Leoh replied. "Um-m-m . . . is Hector your first name or your last?"

"Both, sir."

I should have guessed, Leoh told himself. Aloud, he said, "Well, lieutenant, we'd better get to the shuttle before it leaves without us."

They took to the slideway. Half a second later, Hector jumped off and dashed back to the communications desk for his traveling kit. He hurried back to Leoh, bumping into seven bewildered citizens of various descriptions and nearly breaking both his legs when he tripped as he ran back onto the moving slideway. He went down on his face, sprawled across two lanes moving at different speeds, and needed the assistance of several persons before he was again on his feet and standing beside Leoh.

"I . . . I'm sorry to cause all that, uh, commotion, sir."

"That's all right. You weren't hurt, were you?"

"Uh, no . . . I don't think so. Just embarrassed."

Leoh said nothing. They rode the slideway in silence through the busy station and out to the enclosed berths where the planetary shuttles were docked. They boarded one of the ships and found a pair of seats.

"Just how long have you been with the Star Watch, lieutenant?"

"Six weeks, sir. Three weeks aboard a starship bringing me out to Perseus Alpha VI, a week at the planetary base there, and two weeks aboard the cruiser SW4-J188. That is, it's been six weeks since I received my commission. I've been at the Academy . . . the Star Watch Academy on Mars . . . for four years."

"You got through the Academy in four years?"

"That's the regulation time, sir."

"Yes, I know."

The ship eased out of its berth. There was a moment of free-fall, then the drive engine came on and the gravfield equilibrated.

"Tell me, lieutenant, how did you get picked for this assignment?"

"I wish I knew, sir," Hector said, his lean face twisting into a puzzled frown. "I was working out a program for the navigation officer . . . aboard the cruiser. I'm pretty good at that . . . I can work out computer programs in my head, mostly. Mathematics was my best subject at the Academy—"

"Interesting."

"Yes, well, anyway, I was working out this program when the captain himself came on deck and started shaking my hand and telling me that I was being sent on special duty on Acquatainia by direct orders of the Commander-in-Chief. He seemed very happy . . . the captain, that is."

"He was no doubt pleased to see you get such an unusual assignment," Leoh said tactfully.

"I'm not so sure," Hector said truthfully. "I think he regarded me as some sort of a problem, sir. He had me on a different duty-berth practically every day I was on board the ship."

"Well now," Leoh changed the subject, "what do you know about psychonics?"

"About what, sir?"

"Eh . . . electroencephalography?"

Hector looked blank.

"Psychology, perhaps?" Leoh suggested, hopefully. "Physiology? Computer molectronics?"

"I'm pretty good at mathematics!"

"Yes, I know. Did you, by any chance, receive any training in diplomatic affairs?"

"At the Star Watch Academy? No, sir."

Leoh ran a hand through his thinning hair. "Then why did the Star Watch select you for this job? I must confess, lieutenant, that I can't understand the workings of a military organization."

Hector shook his head ruefully, "Neither do I, sir."

VII

The next week was an enervatingly slow one for Leoh, evenly divided between tedious checking of each component of the dueling machine, and shameless

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rouses to keep Hector as far away from the machine as possible.

The Star Watchman certainly wanted to help, and he actually *was* little short of brilliant in doing intricate mathematics completely in his head. But he was, Leoh found, a clumsy, chattering, whistling, scatterbrained, inexperienced bundle of noise and nerves. It was impossible to do constructive work with him nearby.

Perhaps you're judging him too harshly, Leoh warned himself. *You just might be letting your frustrations with the dueling machine get the better of your sense of balance.*

The professor was sitting in the office that the Acquatainians had given him in one end of the former lecture hall that held the dueling machine. Leoh could see its impassive metal hulk through the open office door.

The room he was sitting in had been one of a suite of offices used by the permanent staff of the machine. But they had moved out of the building completely, in deference to Leoh, and the Acquatainian government had turned the other cubbyhole offices into sleeping rooms for the professor and the Star Watchman, and an autokitchen. A combination cook-valet-handyman appeared twice each day—morning and evening—to handle any special chores that the cleaning machines and autokitchen might miss.

Leoh slouched back in his desk chair and cast a weary eye on the stack of papers that recorded the latest performances of the machine. Earlier that day he had taken the electroencephalographic records of clinical cases of catatonia and run them through the machine's input unit. The machine immediately rejected them, refused to process them through the amplification units and association circuits.

In other words, the machine had recognized the EEG traces as something harmful to a human being.

Then how did it happen to Dulaq? Leoh asked himself for the thousandth time. It couldn't have been the machine's fault; it must have been something in Odal's mind that simply overpowered Dulaq's.

"Overpowered?" That's a terribly unscientific term, Leoh argued against himself.

Before he could carry the debate any further, he heard the main door of the big chamber slide open and then bang shut, and Hector's off-key whistle shrilled and echoed through the high-vaulted room.

Leoh sighed and put his self-contained argument off to the back of his mind. Trying to think logically near Hector was a hopeless prospect.

"Are you in, doctor?" Hector's voice rang out.

"In here."

Hector ducked in through the doorway and plopped his rangy frame on the office's couch.

"Everything going well, sir?"

Leoh shrugged. "Not very well, I'm afraid. I can't find anything wrong with the dueling machine. I can't even *force* it to malfunction."

"Well, that's good, isn't it?" Hector chirped happily.

"In a sense," Leoh admitted, feeling slightly nettled at the youth's boundless, pointless optimism. "But, you see, it means that Kanus' people can do things with the machine that I can't."

Hector frowned, considering the problem. "Hm-m-m . . . yes, I guess that's right, too, isn't it?"

"Did you see the girl back to her ship safely?" Leoh asked.

"Yes, sir," Hector replied, bobbing his head vigorously. "She's on her way back to the communications booth at the space station. She said to tell you she enjoyed her visit very much."

"Good. It was, eh, very good of you to escort her about the campus. It kept her out of my hair . . . what's left of it, that is."

Hector grinned. "Oh, I liked showing her around, and all that—And, well, it sort of kept *me* out of your hair, too, didn't it?"

Leoh's eyebrows shot up in surprise.

Hector laughed. "Doctor, I may be clumsy, and I'm certainly no scientist . . . but I'm not completely brainless."

"I'm sorry if I gave you that impression—"

"Oh no . . . don't be sorry. I didn't mean that to sound so . . . well, the way it sounded . . . that is, I know I'm just in your way—" He started to get up.

Leoh waved him back to the couch. "Relax, my boy, relax. You know, I've been sitting here all afternoon wondering what to do next. Somehow, just now, I came to a conclusion."

"Yes?"

"I'm going to leave the Acquataine Cluster and return to Carinae."

"What? But you can't! I mean—"

"Why not? I'm not accomplishing anything here. Whatever it is that this Odal and Kanus have been doing, it's basically a political problem, and not a scientific one. The professional staff of the machine here will catch up to their tricks sooner or later."

"But, sir, if you can't find the answer, how can they?"

"Frankly, I don't know. But, as I said, this is a political problem more than a scientific one. I'm tired and frustrated and I'm feeling my years. I want to return to Carinae and spend the next few months considering beautifully abstract problems about instantaneous transportation devices. Let Massan and the Star Watch worry about Kanus."

"Oh! That's what I came to tell you. Massan has been challenged to a duel by Odal!"

"What?"

"This afternoon, Odal went to the Council building. Picked an argument with Massan right in the main corridor and challenged him."

"Massan accepted?" Leoh asked.

Hector nodded.

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Leoh leaned across his desk and reached for the phone unit. It took a few minutes and a few levels of secretaries and assistants, but finally Massan's dark, bearded face appeared on the screen above the desk.

"You have accepted Odal's challenge?" Leoh asked, without preliminaries.

"We meet next week," Massan replied gravely.

"You should have refused."

"On what pretext?"

"No pretext. A flat refusal, based on the certainty that Odal or someone else from Kerak is tampering with the dueling machine."

Massan shook his head sadly. "My dear learned sir, you still do not comprehend the political situation. The Government of the Acquataine Cluster is much closer to dissolution than I dare to admit openly. The coalition of star groups that Dulaq had constructed to keep the Kerak Worlds neutralized has broken apart completely. This morning, Kanus announced that he would annex Szarno. This afternoon, Odal challenges me."

"I think I see—"

"Of course. The Acquatainian Government is paralyzed now, until the outcome of the duel is known. We cannot effectively intervene in the Szarno crisis until we know who will be heading the Government next week. And, frankly, more than a few members of our Council are now openly favoring Kanus and urging that we establish friendly relations with him before it is too late."

"But, that's all the more reason for refusing the duel," Leoh insisted.

"And be accused of cowardice in my own Council meetings?" Massan smiled grimly. "In politics, my dear sir, the *appearance* of a man means much more than his substance. As a coward, I would soon be out of office. But, perhaps, as the winner of a duel against the invincible Odal . . . or even as a martyr . . . I may accomplish something useful."

Leoh said nothing.

Massan continued, "I put off the duel for a week, hoping that in that time you might discover Odal's secret. I dare not postpone the duel any longer; as it is, the political situation may collapse about our heads at any moment."

"I'll take this machine apart and rebuild it again, molecule by molecule," Leoh promised.

As Massan's image faded from the screen, Leoh turned to Hector. "We have one week to save his life."

"And avert a war, maybe," Hector added.

"Yes." Leoh leaned back in his chair and stared off into infinity.

Hector shuffled his feet, rubbed his nose, whistled a few bars of off-key tunes, and finally blurted, "How can you take apart the dueling machine?"

"Hm-m-m?" Leoh snapped out of his reverie.

"How can you take apart the dueling machine?" Hector repeated. "Looks like a big job to do in a week."

"Yes, it is. But, my boy, perhaps we . . . the two of us . . . can do it."

Hector scratched his head. "Well, uh, sir . . . I'm not very . . . that is, my mechanical aptitude scores at the Academy—"

Leoh smiled at him. "No need for mechanical aptitude, my boy. You were trained to fight, weren't you? We can do the job mentally."

VIII

It was the strangest week of their lives.

Leoh's plan was straightforward: to test the dueling machine, push it to the limits of its performance, by actually operating it—by fighting duels.

They started off easily enough, tentatively probing and flexing their mental muscles. Leoh had used the dueling machines himself many times in the past, but only in tests of the machines' routine performance. Never in actual combat against another human being. To Hector, of course, the machine was a totally new and different experience.

The Acquatainian staff plunged into the project without question, providing Leoh with invaluable help in monitoring and analyzing the duels.

At first, Leoh and Hector did nothing more than play hide-and-seek, with one of them picking an environment and the other trying to find his opponent in it. They wandered through jungles and cities, over glaciers and interplanetary voids, seeking each other—without ever leaving the booths of the dueling machine.

Then, when Leoh was satisfied that the machine could reproduce and amplify thought patterns with strict fidelity, they began to fight light duels. They fenced with blunted foils—Hector won, of course, because of his much faster reflexes. Then they tried other weapons—pistols, sonic beams, grenades—but always with the precaution of imagining themselves to be wearing protective equipment. Strangely, even though Hector was trained in the use of these weapons, Leoh won almost all the bouts. He was neither faster nor more accurate, when they were target-shooting. But when the two of them faced each other, somehow Leoh almost always won.

The machine projects more than thoughts, Leoh told himself. *It projects personality.*

They worked in the dueling machine day and night now, enclosed in the booths for twelve or more hours a day, driving themselves and the machine's regular staff to near-exhaustion. When they gulped their meals, between duels, they were physically ragged and sharp-tempered. They usually fell asleep in Leoh's office, while discussing the results of the day's work.

The duels grew slowly more serious. Leoh was pushing the machine to its limits now, carefully extending the rigors of each bout. And yet, even though he knew exactly what and how much he intended to do in each

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fight, it often took a conscious effort of will to remind himself that the battles he was fighting were actually imaginary.

As the duels became more dangerous, and the artificially-amplified hallucinations began to end in blood and death, Leoh found himself winning more and more frequently. With one part of his mind he was driving to analyze the cause of his consistent success. But another part of him was beginning to really enjoy his prowess.

The strain was telling on Hector. The physical exertion of constant work and practically no relief was considerable in itself. But the emotional effects of being "hurt" and "killed" repeatedly were infinitely worse.

"Perhaps we should stop for a while," Leoh suggested after the fourth day of tests.

"No. I'm all right."

Leoh looked at him. Hector's face was haggard, his eyes bleary.

"You've had enough," Leoh said quietly.

"Please don't make me stop," Hector begged. "I . . . I can't stop now. Please give me a chance to do better. I'm improving . . . I lasted twice as long in this afternoon's two duels as I did in the ones this morning. Please, don't end it now . . . not while I'm completely lost—"

Leoh stared at him. "You want to go on?"

"Yes, sir."

"And if I say no?"

Hector hesitated. Leoh sensed he was struggling with himself. "If you say no," he answered dully, "then it will be no. I can't argue against you any more.

Leoh was silent for a long moment. Finally he opened a desk drawer and took a small bottle from it. "Here, take a sleep capsule. When you wake up we'll try again."

It was dawn when they began again. Leoh entered the dueling machine determined to allow Hector to win. He gave the youthful Star Watchman his choice of weapon and environment. Hector picked one-man scoutships, in planetary orbits. Their weapons were conventional force beams.

But despite his own conscious desire, Leoh found himself winning! The ships spiraled about an unnamed planet, their paths intersecting at least once in every orbit. The problem was to estimate your opponent's orbital position, and then program your own ship so that you arrived at that position either behind or to one side of him. Then you could train your guns on him before he could turn on you.

The problem should have been an easy one for Hector, with his knack for intuitive mental calculation. But Leoh scored the first hit—Hector had piloted his ship into an excellent firing position, but his shot went wide; Leoh maneuvered around clumsily, but managed to register an inconsequential hit on the side of Hector's ship.

In the next three passes, Leoh scored two more hits. Hector's ship was badly damaged now. In return, the Star Watchman had landed one glancing shot on Leoh's ship.

They came around again, and once more Leoh had outguessed his younger opponent. He trained his guns on Hector's ship, then hesitated with his hand poised above the firing button.

Don't kill him again, he warned himself. *His mind can't accept another defeat.*

But Leoh's hand, almost of its own will, reached the button and touched it lightly. Another gram of pressure and the guns would fire.

In that instant's hesitation. Hector pulled his crippled ship around and aimed at Leoh. The Watchman fired a searing blast that jarred Leoh's ship from end to end. Leoh's hand slammed down on the firing button, whether he intended to do it or not, he did not know.

Leoh's shot raked Hector's ship but did not stop it. The two vehicles were hurtling directly at each other. Leoh tried desperately to avert a collision, but Hector bored in grimly, matching Leoh's maneuvers with his own.

The two ships smashed together and exploded.

Abruptly, Leoh found himself in the cramped booth of the dueling machine, his body cold and damp with perspiration, his hands trembling.

He squeezed out of the booth and took a deep breath. Warm sunlight was streaming into the high-vaulted room. The white walls glared brilliantly. Through the tall windows he could see trees and people and clouds in the sky.

Hector walked up to him. For the first time in several days, the Watchman was smiling. Not much, but smiling. "Well, we broke even on that one."

Leoh smiled back, somewhat shakily. "Yes. It was . . . quite an experience. I've never died before."

Hector fidgeted. "It's, uh, not so bad, I guess—It does sort of, well, shatter you, you know."

"Yes. I can see that now."

"Another duel?" Hector asked, nodding his head toward the machine.

"Let's get out of this place for a few hours. Are you hungry?"

"Starved."

They fought seven more duels over the next day and a half. Hector won three of them. It was late afternoon when Leoh called a halt to the tests.

"We can still get in another one or two," the Watchman pointed out.

"No need," Leoh said. "I have all the data I require. Tomorrow Massan meets Odal, unless we can put a stop to it. We have much to do before tomorrow morning."

Hector sagged into the couch. "Just as well. I think I've aged seven years in the past seven days."

"No, my boy," Leoh said gently. "You haven't aged. You've matured."

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IX

It was deep twilight when the groundcar slid to a halt on its cushion of compressed air before the Kerak Embassy.

"I still think it's a mistake to go in there," Hector said. "I mean, you could've called him on the tri-di just as well, couldn't you?"

Leoh shook his head. "Never give an agency of any government the opportunity to say 'hold the line a moment' and then huddle together to consider what to do with you. Nineteen times out of twenty, they'll end by passing your request up to the next higher echelon, and you'll be left waiting for weeks."

"Still," Hector insisted, "you're simply stepping into enemy territory. It's a chance you shouldn't take."

"They wouldn't dare touch us."

Hector did not reply, but he looked unconvinced.

"Look," Leoh said, "there are only two men alive who can shed light on this matter. One of them is Dulaq, and his mind is closed to us for an indefinite time. Odal is the only other one who knows what happened."

Hector shook his head skeptically. Leoh shrugged, and opened the door of the groundcar. Hector had no choice but to get out and follow him as he walked up the pathway to the main entrance of the Embassy. The building stood gaunt and gray in the dusk, surrounded by a precisely-clipped hedge. The entrance was flanked by a pair of tall evergreen trees.

Leoh and Hector were met just inside the entrance by a female receptionist. She looked just a trifle disheveled —as though she had been rushed to the desk at a moment's notice. They asked for Odal, were ushered into a sitting room, and within a few minutes—to Hector's surprise—were informed by the girl that Major Odal would be with them shortly.

"You see," Leoh pointed out jovially, "when you come in person they haven't as much of a chance to consider how to get rid of you."

Hector glanced around the windowless room and contemplated the thick, solidly closed door. "There's a lot of scurrying going on on the other side of that door, I'll bet. I mean . . . they may be considering how to, uh, get rid of us . . . permanently."

Leoh shook his head, smiling wryly. "Undoubtedly the approach closest to their hearts—but highly improbable in the present situation. They have been making most efficient and effective use of the dueling machine to gain their ends."

Odal picked this moment to open the door.

"Dr. Leoh . . . Lt. Hector . . . you asked to see me?"

"Thank you, Major Odal; I hope you will be able to help me," said Leoh. "You are the only man living who may be able to give us some clues to the failure of the Dueling Machine."

Odal's answering smile reminded Leoh of the best efforts of the robot-puppet designers to make a machine that smiled like a man. "I am afraid I can be of no assistance, Dr. Leoh. My experiences in the machine are . . . private."

"Perhaps you don't fully understand the situation," Leoh said. "In the past week, we have tested the dueling machine here on Acquatainia exhaustively. We have learned that its performance can be greatly influenced by a man's personality, and by training. You have fought many duels in the machines. Your background of experience, both as a professional soldier and in the machines, gives you a decided advantage over your opponents.

"However, even with all this considered, I am convinced that you cannot kill a man in the machine—under normal circumstances. We have demonstrated that fact in our tests. An unsabotaged machine cannot cause actual physical harm.

"Yet you have already killed one man and incapacitated another. Where will it stop?"

Odal's face remained calm, except for the faintest glitter of fire deep in his eyes. His voice was quiet, but had the edge of a well-honed blade to it: "I cannot be blamed for my background and experience. And I have not tampered with your machines."

The door to the room opened, and a short, thick-set, bullet-headed man entered. He was dressed in a dark street suit, so that it was impossible to guess his station at the Embassy.

"Would the gentlemen care for refreshments?" he asked in a low-pitched voice.

"No, thank you," Leoh said.

"Some Kerak wine, perhaps?"

"Well—"

"I don't, uh, think we'd better, sir," Hector said. "Thanks all the same."

The man shrugged and sat at a chair next to the door.

Odal turned back to Leoh. "Sir, I have my duty. Massan and I duel tomorrow. There is no possibility of postponing it."

"Very well," Leoh said. "Will you at least allow us to place some special instrumentation into the booth with you, so that we can monitor the duel more fully? We can do the same with Massan. I know that duels are normally private and you would be within your legal rights to refuse the request. But, morally—"

The smile returned to Odal's face. "You wish to monitor my thoughts. To record them and see how I perform during the duel. Interesting. Very interesting—"

The man at the door rose and said, "If you have no desire for refreshments, gentlemen—"

Odal turned to him. "Thank you for your attention."

Their eyes met and locked for an instant. The man gave a barely perceptible shake of his head, then left.

Odal returned his attention to Leoh. "I am sorry, professor, but I cannot allow you to monitor my thoughts during the duel."

"But—"

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"I regret having to refuse you. But, as you yourself pointed out, there is no legal requirement for such a course of action. I must refuse. I hope you understand."

Leoh rose from the couch, and Hector popped up beside him. "I'm afraid I do understand. And I, too, regret your decision."

Odal escorted them out to their car. They drove away, and the Kerak major walked slowly back into the Embassy building. He was met in the hallway by the dark-suited man who had sat in on the conversation.

"I could have let them monitor my thoughts and still crush Massan," Odal said. "It would have been a good joke on them."

The man grunted. "I have just spoken to the Chancellor on the tri-di, and obtained permission to make a slight adjustment in our plans."

"An adjustment, Minister Kor?"

"After your duel tomorrow, your next opponent will be the eminent Dr. Leoh," Kor said.

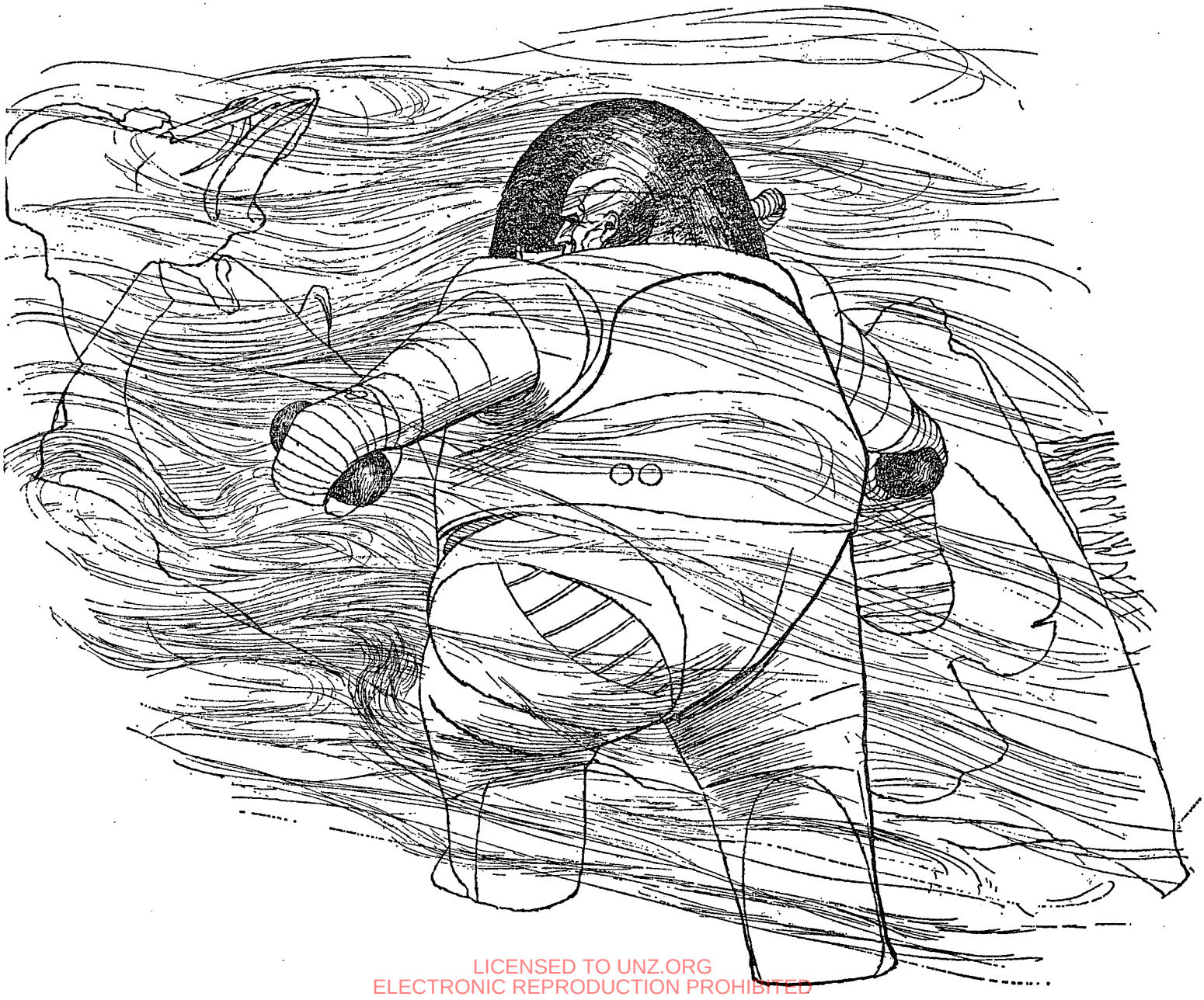
X

The mists swirled deep and impenetrable about Fernd Massan. He stared blindly through the useless viewplate in his helmet, then reached up slowly and carefully to place the infrared detector before his eyes.

I never realized an hallucination could seem so real, Massan thought.

Since the challenge by Odal, he realized, the actual world had seemed quite unreal. For a week, he had gone through the motions of life, but felt as though he were standing aside, a spectator mind watching its own body from a distance. The gathering of his friends and associates last night, the night before the duel—that silent, funereal group of people—it had all seemed completely unreal to him.

But now, in this manufactured dream, he seemed vibrantly alive. Every sensation was solid, stimulating. He could feel his pulse throbbing through him. Some-



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where out in those mists, he knew, was Odal. And the thought of coming to grips with the assassin filled him with a strange satisfaction.

Massan had spent a good many years serving his government on the rich but inhospitable high-gravity planets of the Acquataine Cluster. This was the environment he had chosen: crushing gravity; killing pressures; atmosphere of ammonia and hydrogen, laced with free radicals of sulphur and other valuable but deadly chemicals; oceans of liquid methane and ammonia; "solid ground" consisting of quickly crumbling, eroding ice; howling superpowerful winds that could pick up a mountain of ice and hurl it halfway around the planet; darkness; danger; death.

He was encased in a one-man protective outfit that was half armored suit, half vehicle. There was an internal grav field to keep him comfortable in 3.7 gees, but still the suit was cumbersome, and a man could move only very slowly in it, even with the aid of servomotors.

The weapon he had chosen was simplicity itself—a hand-sized capsule of oxygen. But in a hydrogen/ammonia atmosphere, oxygen could be a deadly explosive. Massan carried several of these "bombs"; so did Odal. *But the trick,* Massan thought to himself, *is to know how to throw them under these conditions; the proper range, the proper trajectory. Not an easy thing to learn, without years of experience.*

The terms of the duel were simple: Massan and Odal were situated on a rough-topped iceberg that was being swirled along one of the methane/ammonia ocean's vicious currents. The ice was rapidly crumbling; the duel would end when the iceberg was completely broken up.

Massan edged along the ragged terrain. His suit's grippers and rollers automatically adjusted to the roughness of the topography. He concentrated his attention on the infrared detector that hung before his viewplate.

A chunk of ice the size of a man's head sailed through the murky atmosphere in a steep glide peculiar to heavy gravity and banged into the shoulder of Massan's suit. The force was enough to rock him slightly off-balance before the servos readjusted. Massan withdrew his arm from the sleeve and felt the inside of the shoulder seam. *Dented, but not penetrated.* A leak would have been disastrous, possibly fatal. Then he remembered: *Of course —I cannot be killed except by direct action of my antagonist. That is one of the rules of the game.*

Still, he carefully fingered the dented shoulder to make certain it was not leaking. The dueling machine and its rules seemed so very remote and unsubstantial, compared to this freezing, howling inferno.

He diligently set about combing the iceberg, determined to find Odal and kill him before their floating island disintegrated. He thoroughly explored every projection, every crevice, every slope, working his way slowly from one end of the 'berg toward the other. Back and forth, cross and re-cross, with the infrared sensors scanning three hundreds sixty-degrees around him.

It was time-consuming. Even with the suit's servomotors and propulsion units, motion across the ice, against the buffeting wind, was a cumbersome business. But Massan continued to work his way across the iceberg, fighting down a gnawing, growing fear that Odal was *not there at all.*

And then he caught just the barest flicker of a shadow on his detector. Something, or someone, had darted behind a jutting rise of the ice, off by the edge of the iceberg.

Slowly and carefully, Massan made his way toward the base of the rise. He picked one of the oxy-bombs from his belt and held it in his right-hand claw.

Massan edged around the base of the ice cliff, and stood on a narrow ledge between the cliff and the churning sea. He saw no one. He extended the detector's range to maximum, and worked the scanners up the sheer face of the cliff toward the top.

There he was! The shadowy outline of a man etched itself on the detector screen. And at the same time, Massan heard a muffled roar, then a rumbling, crashing noise, growing quickly louder and more menacing.

He looked up the face of the ice cliff and saw a small avalanche of ice tumbling, sliding, growling toward him. *That devil set off a bomb at the top of the cliff!*

Massan tried to back out of the way, but it was too late. The first chunk of ice bounced harmlessly off his helmet, but the others knocked him off-balance so repeatedly that the servos had no chance to recover. He staggered blindly for a few moments, as more and more ice eascaded down on him, and then toppled off the ledge into the boiling sea.

Relax! he ordered himself. *Do not panic! The suit will float you. The servos will keep you right-side-up. You cannot be killed accidentally; Odal must perform the* coup-de-grace *himself.*

Then he remembered the emergency rocket units in the back of the suit. If he could orient himself properly, a touch of a control stud on his belt would set them off, and he would be boosted back onto the iceberg. He turned slightly inside the suit and tried to judge the iceberg's distance through the infrared detector. It was difficult, especially since he was bobbing madly in the churning currents.

Finally he decided to fire the rocket and make final adjustments of distance and landing site after he was safely out of the sea.

But he could not move his hand.

He tried, but his entire right arm was locked fast. He could not budge it an inch. And the same for the left. Something, or someone, was clamping his arms tight. He could not even pull them out of their sleeves.

Massan thrashed about, trying to shake off whatever it was. No use.

Then his detector screen was lifted slowly from the

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viewplate. He felt something vibrating on his helmet. The oxygen tubes! They were being disconnected.

He screamed and tried to fight free. No use. With a hiss, the oxygen tubes pulled free of his helmet. Massan could feel the blood pounding through his veins as he fought desperately to free himself.

Now he was being pushed down into the sea. He screamed again and tried to wrench his body away. The frothing sea filled his viewplate. He was under. He was being held under. And now . . . now the viewplate itself was being loosened.

No! Don't! The scalding cold methane ammonia sea seeped in through the opening viewplate.

"It's only a dream!" Massan shouted to himself. "Only a dream. A dream. A—"

XI

Dr. Leoh stared at the dinner table without really seeing it. Coming to this restaurant had been Hector's idea. Three hours earlier, Massan had been removed from the dueling machine—dead.

Leoh sat stolidly, hands in lap, his mind racing in many different directions at once. Hector was off at the phone, getting the latest information from the meditechs. Odal had expressed his regrets perfunctorily, and then left for the Kerak Embassy, under a heavy escort of his own plainclothes guards. The government of the Acquataine Cluster was quite literally falling apart, with no man willing to assume responsibility . . . and thereby expose himself. One hour after the duel, Kanus' troops had landed on all the major planets of the Szarno Confederacy; the annexation was a *fait accompli.*

And what have I done since I arrived on Acquatainia? Leoh demanded of himself. *Nothing. Absolutely nothing. I have sat back like a doddering old professor and played academic games with the machine, while younger, more vigorous men have USED the machine to suit their purposes.*

Used the machine. There was a fragment of an idea in that phrase. Something nebulous, that must be approached carefully or it will fade away. Used the machine . . . used it . . . Leoh toyed with the phrase for a few moments, then gave it up with a sigh of resignation. *Lord, I'm too tired even to think.*

Leoh focused his attention on his surroundings and scanned the busy dining room. It was a beautiful place, really; decorated with crystal and genuine woods and fabric draperies. Not a synthetic in sight. The waiters and cooks and busboys were humans, not the autocookers and servers that most restaurants employed. Leoh suddenly felt touched at Hector's attempt to restore his spirits—even if it *was* being done at Star Watch expense.

He saw the young Watchman approaching the table, coming back from the phone. Hector bumped two waiters and stumbled over a chair before reaching the relative safety of his own seat.

"What's the verdict?" Leoh asked.

Hector's lean face was bleak. "Couldn't revive him. Cerebral hemorrhage, the meditechs said—induced by shock."

"Shock?"

"That's what they said. Something must've, uh, overloaded his nervous system . . . I guess."

Leoh shook his head. "I just don't understand any of this. I might as well admit it. I'm no closer to an answer now than I was when I arrived here. Perhaps I should have retired years ago, before the dueling machine was invented."

"Nonsense."

"No, I mean it." Leoh said. "This is the first real intellectual puzzle I've had to contend with in years. Tinkering with machinery . . . that's easy. You know what you want, all you need is to make the machinery perform properly. But this . . . I'm afraid I'm too old to handle a real problem like this."

Hector scratched his nose thoughtfully, then answered. "If you can't handle the problem, sir, then we're going to have a war on our hands in a matter of weeks. I mean, Kanus won't be satisfied with swallowing the Szarno group . . . the Acquataine Cluster is next . . . and he'll have to fight to get it."

"Then the Star Watch can step in," Leoh said, resignedly.

"Maybe . . . but it'll take time to mobilize the Star Watch . . . Kanus can move a lot faster than we can. Sure, we could throw in a task force . . . a token group, that is. But Kanus' gang will chew them up pretty quick. I . . . I'm no politician, sir, but I think I can see what will happen. Kerak will gobble up the Acquataine Cluster . . . a Star Watch task force will be wiped out in the battle . . . and we'll end up with Kerak at war with the Terran Commonwealth. And it'll be a real war . . . a big one."

Leoh began to answer, then stopped. His eyes were fixed on the far entrance of the dining room. Suddenly every murmur in the busy room stopped dead. Waiters stood still between tables. Eating, drinking, conversation hung suspended.

Hector turned in his chair and saw at the far entrance the slim, stiff, blue-uniformed figure of Odal.

The moment of silence passed. Everyone turned to his own business and avoided looking at the Kerak major. Odal, with a faint smile on his thin face, made his way slowly to the table where Hector and Leoh were sitting.

They rose to greet him and exchanged perfunctory salutations. Odal pulled up a chair and sat with them.

"I assume that you've been looking for me," Leoh said. "What do you wish to say?"

Before Odal could answer, the waiter assigned to the table walked up, took a position where his back would be to the Kerak major, and asked firmly, "Your dinner is ready gentlemen. Shall I serve it now?"

Leoh hesitated a moment, then asked Odal, "Will you join us?"

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"I'm afraid not."

"Serve it now," Hector said. "The major will be leaving shortly."

Again the tight grin broke across Odal's face. The waiter bowed and left.

"I have been thinking about our conversation of last night," Odal said to Leoh.

"Yes?"

"You accused me of cheating in my duels."

Leoh's eyebrows arched. "I said someone was cheating, yes—"

"An accusation is an accusation."

Leoh said nothing.

"Do you withdraw your words, or do you still accuse me of deliberate murder? I am willing to allow you to apologize and leave Acquatainia in peace."

Hector cleared his throat noisily. "This is no place to have an argument . . . besides, here comes our dinner."

Odal ignored the Watchman. "You heard me, professor. Will you leave? Or do you accuse me of murdering Massan this afternoon?"

"I—"

Hector banged his fist on the table and jerked up out of his chair—just as the waiter arrived with a large tray of food. There was a loud crash. A tureen of soup, two bowls of salad, glasses, assorted rolls, vegetables, cheeses and other delicacies cascaded over Odal.

The Kerak major leaped to his feet, swearing violently in his native tongue. He sputtered back into basic Terran: "You clumsy, stupid oaf! You maggot-brained misbegotten peasant-faced—"

Hector calmly picked a salad leaf from the sleeve of his tunic. Odal abruptly stopped his tirade.

"I am clumsy," Hector said, grinning. "As for being stupid, and the rest of it, I resent that. I am highly insulted."

A flash of recognition lighted Odal's eyes. "I see. Of course. My quarrel here is not with you. I apologize." He turned back to Leoh, who was also standing now.

"Not good enough," Hector said. "I don't, uh, like the . . . tone of your apology."

Leoh raised a hand, as if to silence the younger man.

"I apologized; that is sufficient," Odal warned.

Hector took a step toward Odal. "I guess I could insult your glorious leader, or something like that . . . but this seems more direct." He took the water pitcher from the table and poured it calmly and carefully over Odal's head.

A wave of laughter swept the room. Odal went white. "You are determined to die." He wiped the dripping water from his eyes. "I will meet you before the week is out. And you have saved no one." He turned on his heel and stalked out.

"Do you realize what you've done?" Leoh asked, aghast.

Hector shrugged. "He was going to challenge you—"

"He will still challenge me, after you're dead."

"Uu-m-m, yes, well, maybe so. I guess you're right—Well, anyway, we've gained a little more time."

"Four days." Leoh shook his head. "Four days to the end of the week. All right, come on, we have work to do."

Hector was grinning broadly as they left the restaurant. He began to whistle.

"What are you so happy about?" Leoh grumbled.

"About you, sir. When we came in here, you were, uh, well . . . almost beaten. Now you're right back in the game again."

Leoh glanced at the Star Watchman. "In your own odd way, Hector, you're quite a boy . . . I think."

XII

Their groundcar glided from the parking building to the restaurant's entrance ramp, at the radio call of the doorman. Within minutes, Hector and Leoh were cruising through the city, in the deepening shadows of night.

"There's only one man," Leoh said, "who has faced Odal and lived through it."

"Dulaq," Hector agreed. "But . . . for all the information the medical people have been able to get from him, he might as well be, uh, dead."

"He's still completely withdrawn?"

Hector nodded. "The medicos think that . . . well, maybe in a few months, with drugs and psychotherapy and all that . . . they might be able to bring him back."

"It won't be soon enough. We've only got four days."

"I know."

Leoh was silent for several minutes. Then: "Who is Dulaq's closest living relative? Does he have a wife?"

"I think his wife is, uh, dead. Has a daughter though. Pretty girl. Bumped into her in the hospital once or twice—"

Leoh smiled in the darkness. Hector's term, "bumped into," was probably completely literal.

"Why are you asking about Dulaq's next-of-kin?"

"Because," Leoh replied, "I think there might be a way to make Dulaq tell us what happened during his duel. But it is a very dangerous way. Perhaps a fatal way."

"Oh."

They lapsed into silence again. Finally he blurted, "Come on, my boy, let's find the daughter and talk to her."

"Tonight?"

"Now."

She certainly is a pretty girl, Leoh thought as he explained very carefully to Geri Dulaq what he proposed to do. She sat quietly and politely in the spacious living room of the Dulaq residence. The glittering chandelier cast touches of fire on her chestnut hair. Her slim body was slightly rigid with tension, her hands were

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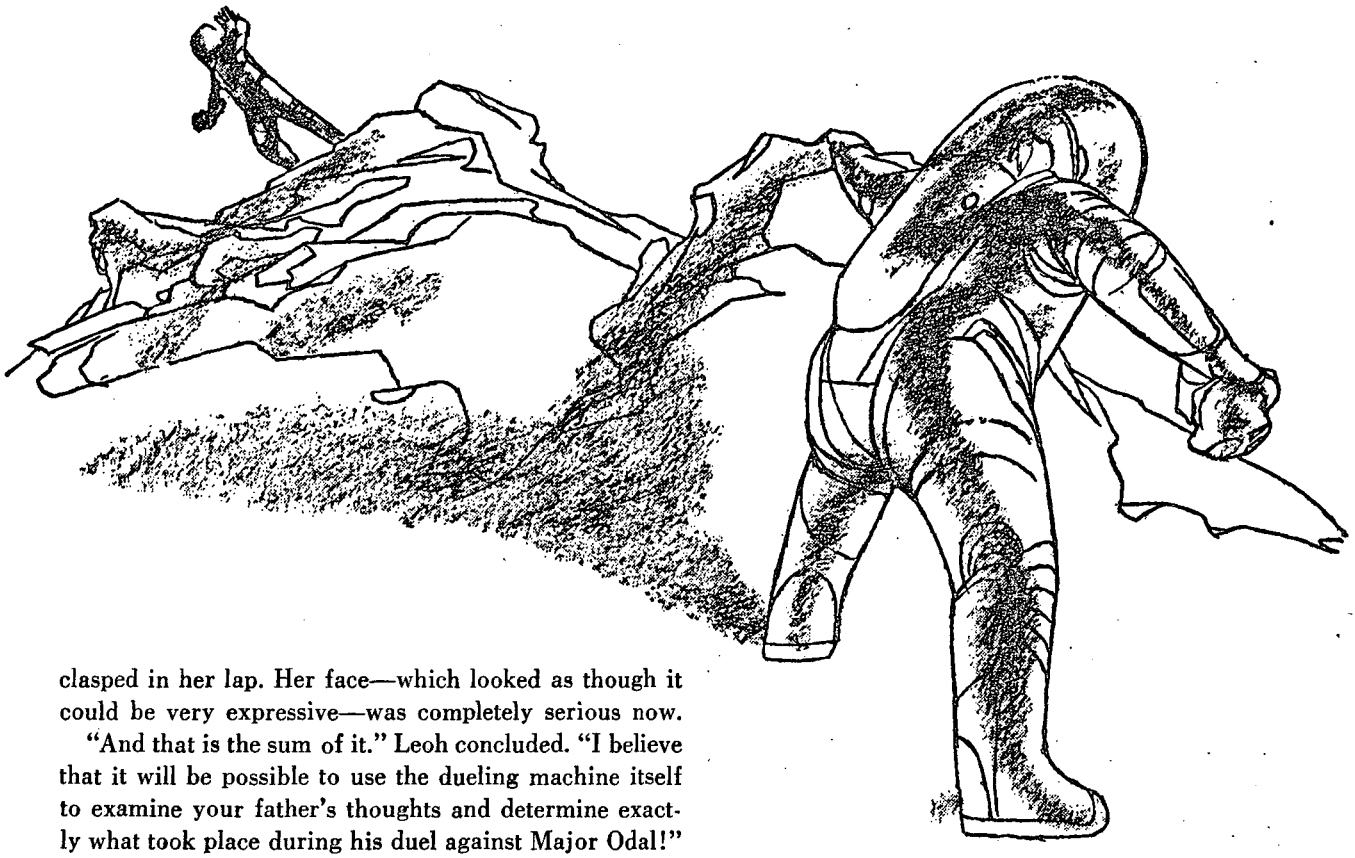

clasped in her lap. Her face—which looked as though it could be very expressive—was completely serious now.

"And that is the sum of it." Leoh concluded. "I believe that it will be possible to use the dueling machine itself to examine your father's thoughts and determine exactly what took place during his duel against Major Odal!"

She asked softly, "But you are afraid that the shock might be repeated, and this could be fatal to my father?"

Leoh nodded wordlessly.

"Then I am very sorry, sir, but I must say no." Firmly.

"I understand your feelings," Leoh replied, "but I hope you realize that unless we can stop Odal and Kanus immediately, we may very well be faced with war."

She nodded. "I know. But you must remember that we are speaking of my father, of his very life. Kanus will have his war in any event, no matter what I do."

"Perhaps," Leoh admitted, "Perhaps."

Hector and Leoh drove back to the University campus and their quarters in the dueling machine chamber. Neither of them slept well that night.

The next morning, after an unenthusiastic breakfast, they found themselves standing in the antiseptic-white chamber, before the looming, impersonal intricacy of the machine.

"Would you like to practice with it?" Leoh asked.

Hector shook his head. "Maybe later."

The phone chimed in Leoh's office. They both went in. Geri Dulaq's faced showed on the tri-di screen.

"I have just heard the news. I did not know that Lieutenant Hector has challenged Odal." Her face was a mixture of concern and reluctance.

"He challenged Odal," Leoh answered, "to prevent the assassin from challenging me."

"Oh—You are a very brave man, lieutenant."

Hector's face went through various contortions and slowly turned a definite red, but no words issued from his mouth.

"Have you reconsidered your decision?" Leoh asked.

The girl closed her eyes briefly, then said flatly, "I am afraid I cannot change my decision. My father's safety is my first responsibility. I am sorry."

They exchanged a few meaningless trivialities—with Hector still thoroughly tongue-tied and ended the conversation on a polite but strained note.

Leoh rubbed his thumb across the phone switch for a moment, then turned to Hector. "My boy, I think it would be a good idea for you to go straight to the hospital and check on Dulaq's condition."

"But . . . why—"

"Don't argue, son. This could be vitally important."

Hector shrugged and left the office. Leoh sat down at his desk and drummed his fingers on the top of it. Then he burst out of the office and began pacing the big chamber. Finally, even that was too confining. He left the building and started stalking through the campus. He walked past a dozen buildings, turned and strode as far as the decorative fence that marked the end of the main campus, ignoring students and faculty alike.

Campuses are all alike, he muttered to himself, *on every human planet, for all the centuries there have been universities. There must be some fundamental reason for it.*

Leoh was halfway back to the dueling machine facility when he spotted Hector walking dazedly toward the same building. For once, the Watchman was not whistling. Leoh cut across some lawn and pulled up beside the youth.

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"Well?" he asked.

Hector shook his head, as if to clear away an inner fog. "How did you know she'd be at the hospital?"

"The wisdom of age. What happened?"

"She kissed me. Right there in the hallway of the—"

"Spare me the geography," Leoh cut in. "What did she say?"

"I bumped into her in the hallway. We, uh, started talking . . . sort of. She seemed, well . . . worried about me. She got upset. Emotional. You know? I guess I looked pretty forlorn and frightened. I am . . . I guess. When you get right down to it, I mean."

"You aroused her maternal instinct."

"I . . . I don't think it was that . . . exactly. Well, anyway, she said that if I was willing to risk my life to save yours, she couldn't protect her father any more. Said she was doing it out of selfishness, really, since he's her only living relative. I don't believe she meant that, but she said it anyway."

They had reached the building by now. Leoh grabbed Hector's arm and steered him clear of a collision with the half-open door.

"She's agreed to let us put Dulaq in the dueling machine?"

"Sort of."

"Eh?"

"The medical staff doesn't want him to be moved from the hospital . . . especially not back to here. She agrees with them."

Leoh snorted. "All right. In fact, so much the better. I'd rather not have the Kerak people see us bring Dulaq to the dueling machine. So instead, we shall smuggle the dueling machine to Dulaq!"

XIII

They plunged to work immediately. Leoh preferred not to inform the regular staff of the dueling machine about their plan, so he and Hector had to work through the night and most of the next morning. Hector barely understood what he was doing, but with Leoh's supervision, he managed to dismantle part of the dueling machine's central network, insert a few additional black boxes that the professor had conjured up from the spare parts bins in the basement, and then reconstruct the machine so that it looked exactly the same as before they had started.

In between his frequent trips to oversee Hector's work, Leoh had jury-rigged a rather bulky headset and a hand-sized override control circuit.

The late morning sun was streaming through the tall windows when Leoh finally explained it all to Hector.

"A simple matter of technological improvisation," he told the bewildered Watchman. "You have installed a short-range transceiver into the machine, and this headset is a portable transceiver for Dulaq. Now he can sit in his hospital bed and still be 'in' the dueling machine."

Only the three most trusted members of the hospital staff were taken into Leoh's confidence, and they were hardly enthusiastic about Leoh's plan.

"It is a waste of time," said the chief psychophysician, shaking his white-maned head vigorously. "You cannot expect a patient who has shown no positive response to drugs and therapy to respond to your machine."

Leoh argued, Geri Dulaq coaxed. Finally the doctors agreed. With only two days remaining before Hector's duel with Odal, they began to probe Dulaq's mind. Geri remained by her father's bedside while the three doctors fitted the cumbersome transceiver to Dulaq's head and attached the electrodes for the automatic hospital equipment that monitored his physical condition. Hector and Leoh remained at the dueling machine, communicating with the hosppial by phone.

Leoh made a final check of the controls and circuitry, then put in the last call to the tense little group in Dulaq's room. All was ready.

He walked out to the machine, with Hector beside him. Their footsteps echoed hollowly in the sepulchral chamber. Leoh stopped at the nearer booth.

"Now remember," he said, carefully, "I will be holding the emergency control unit in my hand. It will stop the duel the instant I set it off. However, if something should go wrong, you must be prepared to act quickly. Keep a close watch on my physical condition; I've shown you which instruments to check on the control board—"

"Yes, sir."

Leoh nodded and took a deep breath. "Very well then."

He stepped into the booth and sat down. The emergency control unit rested on a shelf at his side; he took it in his hands. He leaned back and waited for the semihypnotic effect to take hold. Dulaq's choice of this very city and the stat-wand were known. But beyond that, everything was locked and sealed in Dulaq's subconscious mind. Could the machine reach into that subconscious, probe past the lock and seal of catatonia, and stimulate Dulaq's mind into repeating the duel?

Slowly, lullingly, the dueling machine's imaginary yet very real mists enveloped Leoh. When the mists cleared, he was standing on the upper pedestrian level of the main commercial street of the city. For a long moment, everything was still.

Have I made contact? Whose eyes am I seeing with, my own or Dulaq's?

And then he sensed it—an amused, somewhat astonished marveling at the reality of the illusion. Dulaq's thoughts!

Make your mind a blank, Leoh told himself. *Watch. Listen. Be passive.*

He became a spectator, seeing and hearing the world through Dulaq's eyes and ears as the Acquatainian Prime Minister advanced through his nightmarish ordeal. He felt the confusion, frustration, apprehension and growing terror as, time and again, Odal appeared

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in the crowd—only to melt into someone else and escape.

The first part of the duel ended, and Leoh was suddenly buffeted by a jumble of thoughts and impressions. Then the thoughts slowly cleared and steadied.

Leoh saw an immense and totally barren plain. Not a tree, not a blade of grass; nothing but bare, rocky ground stretching in all directions to the horizon and a disturbingly harsh yellow sky. At his feet was the weapon Odal had chosen. A primitive club.

He shared Dulaq's sense of dread as he picked up the club and hefted it. Off on the horizon he could see a tall, lithe figure holding a similar club walking toward him.

Despite himself, Leoh could feel his own excitement. He had broken through the shock-created armor that Dulaq's mind had erected! Dulaq was reliving the part of the duel that had caused the shock.

Reluctantly, he advanced to meet Odal. But as they drew closer together, the one figure of his opponent seemed to split apart. Now there were two, four, six of them. Six Odals, six mirror images, all armed with massive, evil clubs, advancing steadily on him.

Six tall, lean, blond assassins, with six cold smiles on their intent faces.

Horrified, completely panicked, he scrambled away, trying to evade the six opponents with the half-dozen clubs raised and poised to strike.

Their young legs and lungs easily outdistanced him. A smash on his back sent him sprawling. One of them kicked his weapon away.

They stood over him for a malevolent, gloating second. Then six strong arms flashed down, again and again, mercilessly. Pain and blood, screaming agony, punctuated by the awful thudding of solid clubs hitting fragile flesh and bone, over and over again, endlessly,

Everything went blank.

Leoh opened his eyes and saw Hector bending over him.

"Are you all right, sir?"

"I . . . I think so."

"The controls all hit the danger mark at once. You were . . . well, sir, you were screaming."

"I don't doubt it," Leoh said.

They walked, with Leoh leaning on Hector's arm, from the dueling machine booth to the office.

"That was . . . an experience," Leoh said, easing himself onto the couch.

"What happened? What did Odal do? What made Dulaq go into shock? How does—"

The old man silenced Hector with a wave of his hand. "One question at a time, please."

Leoh leaned back on the deep couch and told Hector every detail of both parts of the duel.

"Six Odals," Hector muttered soberly, leaning back against the doorframe, "Six against one."

"That's what he did. It's easy to see how a man expecting a polite, formal duel can be completely shattered by the visciousness of such an attack. And the machine amplifies every impulse, every sensation."

"But how does he do it?" Hector asked, his voice suddenly loud and demanding.

"I've been asking myself the same queston. We've checked over the dueling machine time and again. There is no possible way for Odal to plug in five helpers . . . unless—"

"Unless?"

Leoh hesitated, seemingly debating with himself. Finally he nodded his head sharply, and answered, "Unless Odal is telepath."

"Telepath? But—"

"I know it sounds farfetched. But there have been well-documented cases of telepathy for centuries throughout the Commonwealth."

Hector frowned. "Sure, everybody's heard about it . . . natural telepaths . . . but they're so unpredictable . . . I don't see how—"

Leoh leaned forward on the couch and clasped his hands in front of his chin. "The Terran races have never developed telepathy, or any of the extrasensory talents. They never had to, not with tri-di communications and superlight starships. But perhaps the Kerak people are different—"

Hector shook his head. "If they had uh, telepathic abilities, they would be using them everywhere. Don't you think?"

"Probably so. But only Odal has shown such an ability, and only . . . *of course!*"

"What?"

"Odal has shown telepathic ability only in the dueling machine."

"As far as we know."

"Certainly. But look, suppose he's a natural telepath . . . the same as a Terran. He has an erratic, difficult-to-control talent. Then he gets into a dueling machine. The machine amplifies his thoughts. And it also amplifies his talent!"

"Ohhh."

"You see . . . outside the machine, he's no better than any wandering fortuneteller. But the dueling machine gives his natural abilities the amplification and reproducibility that they could never have unaided."

Hector nodded.

"So it's a fairly straightforward matter for him to have five associates in the Kerak Embassy sit in on the duel, so to speak. Possibly they are natural telepaths also, but they needn't be."

"They just, uh, pool their minds with his, hm-m-m? Six men show up in the duel . . . pretty nasty." Hector dropped into the desk chair.

"So what do we do now?"

"Now?" Leoh blinked at his young friend. "Why . . . I suppose the first thing we should do is call the hospital and see how Dulaq came through."

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Leoh put the call through. Geri Dulaq's face appeared on the screen.

"How's your father?" Hector blurted.

"The duel was too much for him," she said blankly. "He is dead."

"No," Leoh groaned.

"I . . . I'm sorry," Hector said. "I'll be right down there. Stay where you are."

The young Star Watchman dashed out of the office as Geri broke the phone connection. Leoh stared at the blank screen for a few moments, then leaned far back in the couch and closed his eyes. He was suddenly exhausted, physically and emotionally. He fell asleep, and dreamed of men dead and dying.

Hector's nerve-shattering whistling woke him up. It was full night outside.

"What are you so happy about?" Leoh groused as Hector popped into the office.

"Happy? Me?"

"You were whistling."

Hector shrugged. "I always whistle, sir. Doesn't mean I'm happy."

"All right," Leoh said, rubbing his eyes. "How did the girl take her father's death?"

"Pretty hard. Cried a lot."

Leoh looked at the younger man. "Does she blame . . . me?"

"You? Why, no, sir. Why should she? Odal . . . Kanus . . . the Kerak Worlds. But not you."

The old professor sighed, relieved. "Very well. Now then, we have much work to do, and little more than a day in which to finish it."

"What do you want me to do?" Hector asked.

"Phone the Star Watch Commander—"

"My commanding officer, all the way back at Alpha Perseus VI? That's a hundred light-years from here."

"No, no, no." Leoh shook his head. "The Commander-in-Chief, Sir Harold Spencer. At Star Watch Central Headquarters. That's several hundred parsecs from here. But get through to him as quickly as possible."

With a low whistle of astonishment, Hector began punching buttons on the phone switch.

XIV

The morning of the duel arrived, and precisely at the agreed-upon hour, Odal and a small retinue of Kerak representatives stepped through the double doors of the dueling machine changer.

Hector and Leoh were already there, waiting. With them stood another man, dressed in the black-and-silver of the Star Watch. He was a blocky, broad-faced veteran with iron-gray hair and hard, unsmiling eyes.

The two little groups of men knotted together in the center of the room, before the machine's control board. The white-uniformed staff meditechs emerged from a far doorway and stood off to one side.

Odal went through the formality of shaking hands with Hector. The Kerak major nodded toward the other Watchman. "Your replacement?" he asked mischievously.

The chief meditech stepped between them. "Since you are the challenged party, Major Odal, you have the first choice of weapon and environment. Are their any instructions or comments necessary before the duel begins?"

"I think not," Odal replied. "The situation will be self-explanatory. I assume, of course, that Star Watchmen are trained to be warriors and not merely technicians. The situation I have chosen is one in which many warriors have won glory."

Hector said nothing.

"I intend," Leoh said firmly, "to assist the staff in monitoring this duel. Your aides may, of course, sit at the control board with me."

Odal nodded.

"If you are ready to begin, gentlemen," the chief meditech said.

Hector and Odal went to their booths. Leoh sat at the control console, and one of the Kerak men sat down next to him.

Hector felt every nerve and muscle tensed as he sat in the booth, despite his efforts to relax. Slowly the tension eased, and he began to feel slightly drowsy. The booth seemed to melt away . . .

He was standing on a grassy meadow. Off in the distance were wooded hills. A cool breeze was hustling puffy white clouds across a calm blue sky.

Hector heard a snuffling noise behind him, and wheeled around. He blinked, then stared.

It had four legs, and was evidently a beast of burden. At least, it carried a saddle on its back. Piled atop the saddle was a conglomeration of what looked to Hector—at first glance—like a pile of junk. He went over to the animal and examined it carefully. The "junk" turned out to be a long spear, various pieces of armor, a helmet, sword, shield, battle-ax and dagger.

The situation I have chosen is one in which many warriors have won glory. Hector puzzled over the assortment of weapons. They came straight out of Kerak's Dark Ages. No doubt Odal had been practicing with them for months, even years. He may not need five helpers.

Warily, Hector put on the armor. The breastplate seemed too big, and he was somehow unable to tighten the greaves on his shins properly. The helmet fit over his head like an ancient oil can, flattening his ears and nose and forcing him to squint to see through the narrow eye-slit.

Finally, he buckled on the sword and found attachments on the saddle for the other weapons. The shield was almost too heavy to lift, and he barely struggled into the saddle with all the weight he was carrying.

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And then he just sat. He began to feel a little ridiculous. *Suppose it rains?* he wondered. But of course it wouldn't.

After an interminable wait, Odal appeared, on a powerful trotting charger. His armor was black as space, and so was his animal. *Naturally,* Hector thought.

Odal saluted gravely with his great spear from across the meadow. Hector returned the salute, nearly dropping his spear in the process.

Then, Odal lowered his spear and aimed it—so it seemed to Hector—directly at the Watchman's ribs. He pricked his mount into a canter. Hector did the same, and his steed jogged into a bumping, jolting gallop. The two warriors hurtled toward each other from opposite ends of the meadow.

And suddenly there were six black figures roaring down on Hector!

The Watchmen's stomach wrenched within him. Automatically he tried to turn his mount aside. But the beast had no intention of going anywhere except straight ahead. The Kerak warriors bore in, six abreast, with six spears aimed menacingly.

Abruptly, Hector heard the pounding of other hoofbeats right beside him. Through a corner of his helmet-slit he glimpsed at least two other warriors charging with him into Odal's crew.

Leoh's gamble had worked. The transceiver that had allowed Dulaq to make contact with the dueling machine from his hospital bed was now allowing five Star Watch officers to join Hector, even though they were physically sitting in a starship orbiting high above the planet.

The odds were even now. The five additional Watchmen were the roughest, hardiest, most aggressive man-to-man fighters that the Star Watch could provide on a one-day notice.

Twelve powerful chargers met head on, and twelve strong men smashed together with an ear-splitting CLANG! Shattered spears showered splinters everywhere. Men and animals went down.

Hector was rocked back in his saddle, but somehow managed to avoid falling off.

On the other hand, he could not really regain his balance, either. Dust and weapons filled the air. A sword hissed near his head and rattled off his shield.

With a supreme effort, Hector pulled out his own sword and thrashed at the nearest rider. It turned out to be a fellow Watchman, but the stroke bounced harmlessly off his helmet.

It was so confusing. The wheeling, snorting animals. Clouds of dust. Screaming, raging men. A black-armored rider charged into Hector, waving a battle-ax over his head. He chopped savagely, and the Watchman's shield split apart. Another frightening swing—Hector tried to duck and slid completely out of the saddle, thumping painfully on the ground, while the ax cleaved the air where his head had been a split-second earlier.

Somehow his helmet had been turned around. Hector tried to decide whether to thrash around blindly or lay down his sword and straighten out the helmet. The problem was solved for him by the *crang!* of a sword against the back of his helmet. The blow flipped him into a somersault, but also knocked the helmet completely off his head.

Hector climbed painfully to his feet, his head spinning. It took him several moments to realize that the battle had stopped. The dust drifted away, and he saw that all the Kerak fighters were down—except one. The black-armored warrior took off his helmet and tossed it aside. It was Odal. Or was it? They all looked alike. *What difference does it make?* Hector wondered. *Odal's mind is the dominant one.*

Odal stood, legs braced apart, sword in hand, and looked uncertainly at the other Star Watchmen. Three of them were afoot and two still mounted. The Kerak assassin seemed as confused as Hector felt. The shock of facing equal numbers had sapped much of his confidence.

Cautiously, he advanced toward Hector, holding his sword out before him. The other Watchmen stood aside while Hector slowly backpedaled, stumbling slightly on the uneven ground.

Odel feinted and cut at Hector's arm. The Watchman barely parried in time. Another feint, at the head, and a slash into the chest; Hector missed the parry but his armor saved him. Grimly, Odal kept advancing. Feint, feint, crack! and Hector's sword went flying from his hand.

For the barest instant everyone froze. Then Hector leaped desperately straight at Odal, caught him completely by surprise, and wrestled him to the ground. The Watchman pulled the sword from his opponent's hand and tossed it away. But with his free hand, Odal clouted Hector on the side of the head and knocked him on his back. Both men scrambled up and ran for the nearest weapons.

Odal picked up a wicked-looking double-bladed ax. One of the mounted Star Watchmen handed Hector a huge broadsword. He gripped it with both hands, but still staggered off-balance as he swung it up over his shoulder.

Holding the broadsword aloft, Hector charged toward Odal, who stood dogged, short-breathed, sweat-streaked, waiting for him. The broadsword was quite heavy, even for a two-handed grip. And Hector did not notice his own battered helmet laying on the ground between them.

Odal, for his part, had Hector's charge and swing timed perfectly in his own mind. He would duck under the swing and bury his ax in the Watchman's chest. Then he would face the others. Probably with their leader gone, the duel would automatically end. But, of course, Hector would not really be dead; the best Odal could hope for now was to win the duel.

Hector charged directly into Odal's plan, but the

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Watchman's timing was much poorer than anticipated. Just as he began the downswing of a mighty broadsword stroke, he stumbled on the helmet. Odal started to duck, then saw that the Watchman was diving face-first into the ground, legs flailing, and that heavy broadsword was cleaving through the air with a will of its own.

Odal pulled back in confusion, only to have the wild-swinging broadsword strike him just above the wrist. The ax dropped out of his hand, and Odal involuntarily grasped the wounded forearm with his left hand. Blood seeped through his fingers.

He shook his head in bitter resignation, turned his back on the prostrate Hector, and began walking away.

Slowly, the scene faded, and Hector found himself sitting in the booth of the dueling machine.

XV

The door opened and Leoh squeezed into the booth. "You're all right?"

Hector blinked and refocused his eyes on reality. "Think so—"

"Everything went well? The Watchmen got through to you?"

"Good thing they did. I was nearly killed anyway."

"But you survived."

"So far."

Across the room, Odal stood massaging his forehead while Kor demanded: "How could they possibly have discovered the secret? Where was the leak?"

"That is not important now," Odal said quietly. "The primary fact is that they have not only discovered our secret, but they have found a way of duplicating it."

"The sanctimonious hypocrites," Kor snarled, "accusing us of cheating, and then they do the same thing."

"Regardless of the moral values of our mutual behavior," Odal said dryly, "it is evident that there is no longer any use in calling on telepathically-guided assistants. I shall face the Watchman alone during the second half of the duel."

"Can you trust them to do the same?"

"Yes. They easily defeated my aides a few minutes ago, then stood aside and allowed the two of us to fight by ourselves."

"And you failed to defeat him?"

Odal frowned. "I was wounded by a fluke. He is a very . . . unusual opponent. I cannot decide whether he is actually as clumsy as he appears to be, or whether he is shamming and trying to make me overconfident. Either way, it is impossible to predict his behavior. Perhaps he is also telepathic."

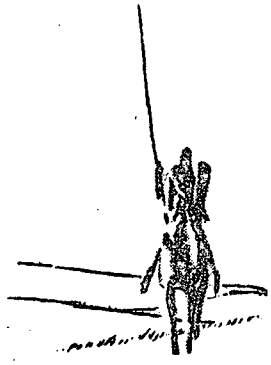
Kor's gray eyes became flat and emotionless. "You know, of course, how the Chancellor will react if you fail to kill this Watchman. Not merely defeat him. He must be killed. The aura of invincibility must be maintained."

"I will do my best," Odal said.

"He must be killed."

The chime that marked the end of the rest period sounded. Odal and Hector returned to their booths. Now it was Hector's choice of environment and weapons.

Odal found himself enveloped in darkness. Only gradually did his eyes adjust. He saw that he was in a spacesuit. For several minutes he stood motionless, peering into the darkness, every sense alert, every muscle coiled



for immediate action.

Dimly he could see the outlines of jagged rock against a background of innumerable stars. Experimentally, he lifted one foot. It stuck, tackily, to the surface. *Magnetized boots,* Odal thought. *This must be a planetoid.*

As his eyes grew accustomed to the dimness, he saw that he was right. It was a small planetoid, perhaps a mile or so in diameter. Almost zero gravity. Airless.

Odal swiveled his head inside the fishbowl helmet of his spacesuit and saw, over his right shoulder, the figure of Hector—lank and ungainly even with the bulky suit. For a moment, Odal puzzled over the weapon to be used. Then Hector bent down, picked up a loose stone, straightened, and tossed it softly past Odal's head. The Kerak major watched it sail by and off into the darkness of space, never to return to the tiny planetoid.

A warning shot, Odal thought to himself. He wondered how much damage one could do with a nearly weightless stone, then remembered that inertial mass was unaffected by gravitational fields, or lack of them. A fifty-pound rock might be easier to lift, but it would be just as hard to throw—and it would do just as much damage when it hit, regardless of its gravitational "weight."

Odal crouched down and selected a stone the size of

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his fist. He rose carefully, sighted Hector standing a hundred yards or so away, and threw as hard as he could.

The effort of his throw sent him tumbling off-balance, and the stone was far off-target. He fell to his hands and knees, bounced lightly and skidded to a stop. Immediately he drew his feet up under his body and planted the magnetized soles of his boots firmly on the iron-rich surface.

But before he could stand again, a small stone *pinged* lightly off his oxygen tank. The Star Watchman had his range, already!

Odal scrambled to the nearest upjutting rocks and crouched behind them. *Lucky I didn't rip open the spacesuit*, he told himself. Three stones, evidently hurled in salvo, ticked off the top of the rocks he was hunched behind. One of the stones bounced into his fishbowl helmet.

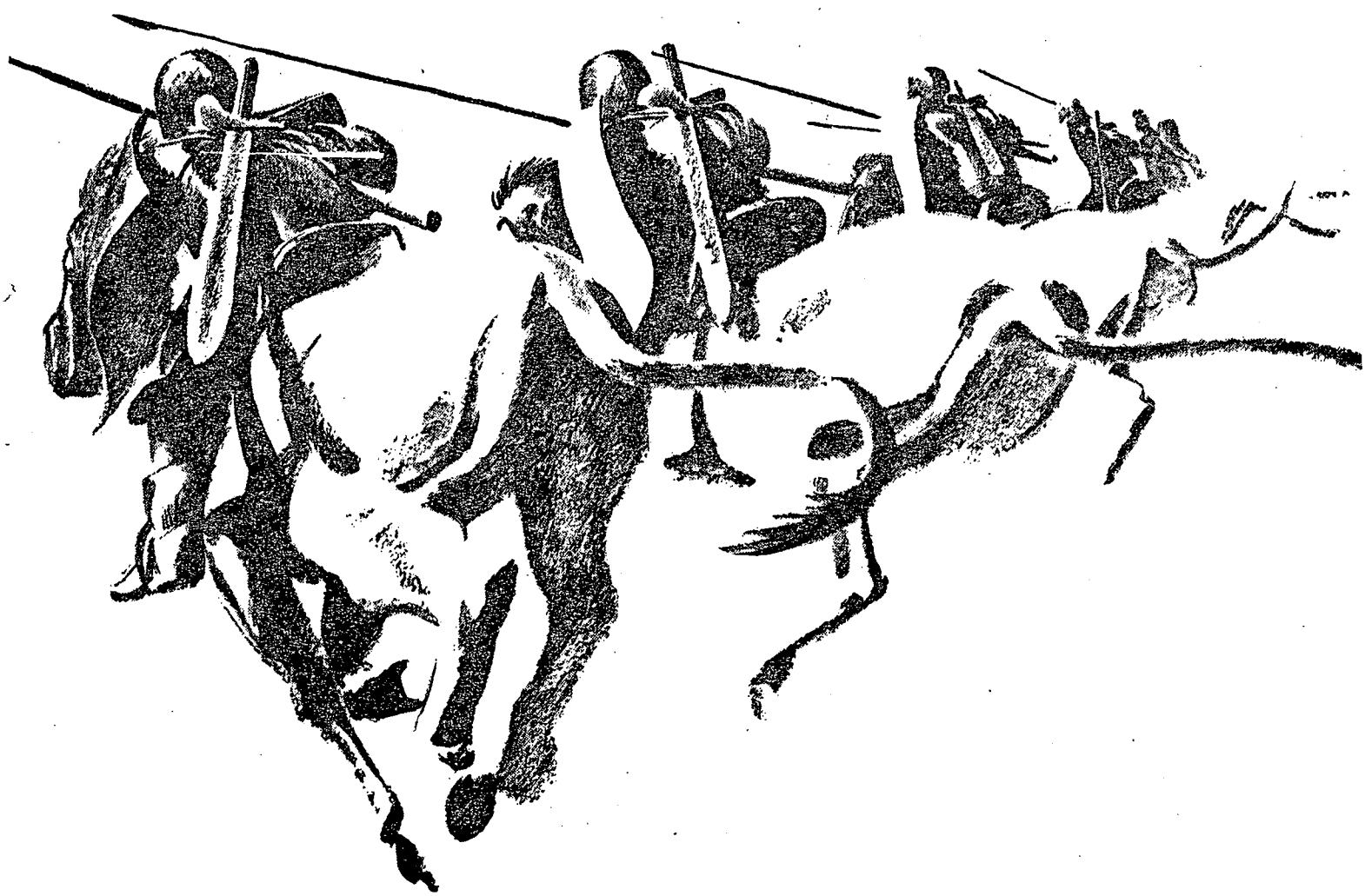
Odal scooped up a handful of pebbles and tossed them in Hector's general direction. That should make him duck. Perhaps he'll stumble and crack his helmet open.

Then he grinned to himself. That's it. Kor wants him dead, and that is the way to do it. Pin him under a big rock, then bury him alive under more rocks. A few at a time, stretched out nicely. While his oxygen supply gives out. That should put enough stress on his nervous system to hospitalize him, at least. Then he can be assassinated by more conventional means. Perhaps he will even be as obliging as Massan, and have a fatal stroke.

A large rock. One that is light enough to lift and throw, yet also big enough to pin him for a few moments. Once he is down, it will be easy enough to bury him under more rocks.

The Kerak major spotted a boulder of the proper size, a few yards away. He backed toward it, throwing small stones in Hector's direction to keep the Watchman busy. In return, a barrage of stones began striking all around him. Several hit him, one hard enough to knock him slightly off-balance.

Slowly, patiently, Odal reached his chosen weapon—an oblong boulder, about the size of a small chair. He



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crouched behind it and tugged at it experimentally. It moved slightly. Another stone *zinged* off his arm, hard enough to hurt. Odal could see Hector clearly now, standing atop a small rise, calmly firing pellets at him. He smiled as he coiled, catlike, and tensed himself. He gripped the boulder with his arms and hands.

Then in one vicious uncoiling motion he snatched it up, whirled around, and hurled it at Hector. The violence of his action sent him tottering awkwardly as he released the boulder. He fell to the ground, but kept his eyes fixed on the boulder as it tumbled end over end, directly at the Watchman.

For an eternally-long instant Hector stood motionless, seemingly entranced. Then he leaped sideways, floating dreamlike in the low gravity, as the stone hurtled inexorably past him.

Odal pounded his fist on the ground in fury. He started up, only to have a good-sized stone slam against his shoulder, and knock him flat again. He looked up in time to see Hector fire another. The stone puffed into the ground inches from Odal's helmet. The Kerak major flattened himself, Several more stones clattered on his helmet and oxygen tank. Then silence.

Odal looked up and saw Hector squatting down, reaching for more ammunition. The Kerak warrior stood up quickly, his own fists filled with throwing stones. He cocked his arm to throw—

But something made him turn to look behind him. The boulder loomed before his eyes, still tumbling slowly, as it had when he had thrown it. It was too close and too big to avoid. It smashed into Odal, picked him off his feet and slammed against the upjutting rocks a few yards away.

Even before he started to feel the pain in his midsection, Odal began trying to push the boulder off. But he could not get enough leverage. Then he saw the Star Watchman's form standing over him.

"I didn't really think you'd fall for it," Odal heard Hector's voice in his earphones. "I mean . . . didn't you realize that the boulder was too massive to escape completely after it had missed me? You could've calculated its orbit . . . you just threw it into a, uh, six-minute orbit around the planetoid. It *had* to come back to perigee . . . right where you were standing when you threw it, you know."

Odal said nothing, but strained every cell in his pain-wracked body to get free of the boulder. Hector reached over his shoulder and began fumbling with the valves that were pressed against the rocks.

"Sorry to do this . . . but I'm not, uh, killing you, at least . . . just defeating you. Let's see . . . one of these is the oxygen valve, and the other, I think, is the emergency rocket pack . . . now, which is which?" Odal felt the Watchman's hands searching for the proper valve. "I shouldn've dreamed up suits without the rocket pack . . . confuses things . . . there, that's it."

Hector's hand tightened on a valve and turned it sharply. The rocket roared to life and Odal was hurtled free of the boulder, shot uncontrolled completely off the planetoid. Hector was bowled over by the blast and rolled halfway around the tiny chink of rock and metal.

Odal tried to reach around to throttle down the rocket, but the pain in his body was too great. He was slipping into unconsciousness. He fought against it. He knew he must return to the planetoid and somehow kill the opponent. But gradually the pain overpowered him. His eyes were closing, closing—

And, quite abruptly, he found himself sitting in the booth of the dueling machine. It took a moment for him to realize that he was back in the real world. Then his thoughts cleared. He had failed to kill Hector.

And at the door of the booth stood Kor, his face a grim mask of anger.

XVI

The office was that of the new prime minister of the Acquataine Cluster. It had been loaned to Leoh for his conversation with Sir Harold Spencer. For the moment, it seemed like a great double room: half of it was dark, warm woods, rich draperies, floor-to-ceiling bookcases. The other half, from the tri-di screen onward, was the austere, metallic utility of a starship compartment.

Spencer was saying, "So this hired assassin, after killing four men and nearly wrecking a government, has returned to his native worlds."

Leoh nodded. "He returned under guard. I suppose he is in disgrace, or perhaps even under arrest."

"Servants of a dictator never know when they will be the ones who are served—on a platter." Spencer chuckled. "And the Watchman who assisted you, this Junior Lieutenant Hector, what of him?"

"He's not here just now. The Dulaq girl has him in tow, somewhere. Evidently it's the first time he's been a hero—"

Spencer shifted his weight in his chair. "I have long prided myself on the conviction that any Star Watch officer can handle almost any kind of emergency anywhere in the galaxy. From your description of the past few weeks, I was beginning to have my doubts. However, Junior Lieutenant Hector seems to have won the day . . . almost in spite of himself."

"Don't underestimate him," Leoh said, smiling. "He turned out to be an extremely valuable man. I think he will make a fine officer."

Spencer grunted an affirmative.

"Well," Leoh said, "that's the complete story, to date. I believe that Odal is finished. But the Kerak Worlds have made good their annexation of the Szarno Confederacy, and the Acquataine Cluster is still very wobbly, politically. We haven't heard the last of Kanus—not by a long shot."

Spencer lifted a shaggy eyebrow. "Neither," he rumbled, "has *he* heard the last from *us*." ■

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ONENESS

At that, you know the power to enforce the Golden Rule would make a terrible weapon!

by JAMES H. SCHMITZ

ILLUSTRATED BY LEO SUMMERS

Menesee felt excitement surge like a living tide about him as he came with the other directors into the vast Tribunal Hall. Sixty years ago, inexcusable carelessness had deprived Earth of its first chance to obtain a true interstellar drive. Now, within a few hours, Earth, or more specifically, the upper echelons of that great political organization called the Machine which had controlled the affairs of Earth for the past century and a half, should learn enough of the secrets of the drive to insure that it would soon be in their possession.

Menesee entered his box between those of Directors Cornelius and Ojeda, immediately to the right of the Spokesman's Platform and with an excellent view of the prisoner. When Administrator Bradshaw and Spokesman Dorn had taken their places on the platform, Menesee seated himself, drawing the transcript of the day's proceedings towards him. However, instead of glancing over it at once, he spent some seconds in a study of the prisoner.

The fellow appeared to be still young. He was a magnificent physical specimen, tall and strongly muscled, easily surpassing in this respect any of the hard-trained directors present. His face showed alert intelligence, giving no indication of the fact that for two of the three days since his capture he had been drugged and subjected to constant hypnotic suggestion. He had given his name as Rainbolt, acknowledged freely that he was a member of the group of malcontent deserters known in the records of the Machine as the Mars Convicts, but described himself as being a "missionary of Oneness" whose purpose was to bring the benefits of some of the principles of "Oneness" to Earth. He had refused to state whether he had any understanding of the stardrive by the use of which the Mars Convicts had made their mass escape from the penal settlements of the Fourth Planet sixty years before, though the drive obviously had been employed in bringing him out of the depths of interstellar space to the Solar System and Earth. At the moment, while the significance of the bank of torture instruments on his right could hardly have escaped him, his expression was serious but not detectably concerned.

"Here is an interesting point!" Director Ojeda's voice said on Menesee's right.

Menesee glanced over at him. Ojeda was tapping the transcript with a finger.

"This Rainbolt," he said, "hasn't slept since he was captured! He states, furthermore, that he has never slept since he became an adult—"

Menesee frowned slightly, failing to see any great significance in the fact. That the fellow belonged to some curious cult which had developed among the Mars Convicts following their flight from the Solar System was already known. Earth's science had methods of inducing permanent sleeplessness but knew, too, that in most instances the condition eventually gave rise to very serious side effects which more than offset any advantages to be gained from it.

He picked up his transcript, indicating that he did not wish to be drawn into conversation. His eyes scanned quickly over the pages. Most of it was information he already had. Rainbolt's ship had been detected four days earlier, probing the outermost of the multiple globes of force screens which had enclosed Earth for fifty years as a defense both against faster-than-light missiles and Mars Convict spies. The ship was alone. A procedure had been planned for such an event, and it was now followed. The ship was permitted to penetrate the first two screens which were closed again behind it.

Rainbolt's ship, for all its incredible speed, was then a prisoner. Unhurriedly, it was worked closer to Earth until it came within range of giant scanners. For an instant, a large section of its interior was visible to the instruments of the watchers on Earth; then the picture blurred and vanished again. Presumably automatic anti-scanning devices had gone into action.

The photographed view was disappointing in that it revealed no details of the engines or their instruments. It did show, however, that the ship had been designed for the use of one man, and that it was neither armored nor armed. Its hull was therefore bathed with paralytics, which in theory should have left the pilot helpless, and ships of the Machine were then sent up to tow the interstellar captive down to Earth.

At that point, the procedure collapsed. The ship was in atmosphere when an escape capsule was suddenly ejected from it, which later was found to contain Rainbolt, alert and obviously not affected by the paralysis beams. A moment later, the ship itself became a cloud of swiftly dissipating hot gas.

The partial failure of the capture might have been

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unavoidable in any case. But the manner in which it occurred still reflected very poorly, Menesee thought, on the thoroughness with which the plans had been prepared. The directors who had been in charge of the operation would not be dealt with lightly—

He became aware suddenly that the proceedings of the day had begun and hastily put down the transcript.

Spokesman Dorn, the Machine's executive officer, sitting beside Administrator Bradshaw at a transparent desk on the raised platform to Menesee's left, had enclosed the area about the prisoner with a sound block and was giving a brief verbal resume of the background of the situation. Few of the directors in the Tribunal Hall would have needed such information; but the matter was being carried on the Grand Assembly Circuit, and in hundreds of auditoriums on Earth the first and second echelons of the officials of the Machine had gathered to witness the interrogation of the Mars Convict spy.

The penal settlements on Mars had been established almost a century earlier, for the dual purpose of mining the mineral riches of the Fourth Planet and of utilizing the talents of political dissidents with a scientific background too valuable to be wasted in research and experimental work considered either too dangerous to be conducted on Earth or requiring more space than could easily be made available there. One of these projects had been precisely the development of more efficient spacedrives to do away with the costly and tedious maneuverings required for travel even among the inner planets.

Work of such importance, of course, was supposed to be carried out only under close guard and under the direct supervision of reliable upper-echelon scientists of the Machine. Even allowing for criminal negligence, the fact that the Mars Convicts were able to develop and test their stardrive under such circumstances without being detected suggested that it could not be a complicated device. They did, at any rate, develop it, armed themselves and the miners of the other penal settlements and overwhelmed their guards in a surprise attack. When the next ship arrived from Earth, two giant ore carriers and a number of smaller guard ships had been outfitted with the drive, and the Mars Convicts had disappeared in them. Their speed was such that only the faintest and briefest of disturbances had been registered on the tracking screens of space stations near Mars, the cause of which remained unsuspected until the news came out.

Anything which could have thrown any light on the nature of the drive naturally had been destroyed by the deserters before they left; and the few Machine scientists who had survived the fighting were unable to provide information though they were questioned intensively for several years before being executed. What it added up to was that some eighteen thousand sworn enemies of the Machine had disappeared into space, equipped with an instrument of unknown type which plainly could be turned into one of the deadliest of all known weapons.

The superb organization of the Machine swung into action instantly to meet the threat, though the situation became complicated by the fact that rumors of the manner in which the Mars Convicts had disappeared filtered out to the politically dissatisfied on Earth and set off an unprecedented series of local uprisings which took over a decade to quell. In spite of such difficulties, the planet's economy was geared over to the new task; and presently defenses were devised and being constructed which would stop missiles arriving at speeds greater than that of light. Simultaneously, the greatest research project in history had begun to investigate the possibilities of either duplicating the fantastic drive some scientific minds on Mars had come upon—chiefly, it was concluded, by an improbable stroke of good luck—or of matching its effects through a different approach. Since it had been demonstrated that it could be done, there was no question that in time the trained men of the Machine would achieve their goal. Then the armed might of the Machine would move into space to take control of any colony established by the Mars Convicts and their descendants.

That was the basic plan. The task of developing a stardrive remained a huge one because of the complete lack of information about the direction organized research should take. That difficulty would be overcome easily only by a second unpredictable twist of fortune—unless one of the Mars Convicts' FTL ships ventured close enough to Earth to be captured.

The last had now happened. The ship had been destroyed before it could be investigated, so that advantage was again lost. The ship's pilot, however, remained in their hands. The fact that he disclaimed having information pertinent to the drive meant nothing. So far as he knew, he might very well be speaking the truth. But he had piloted a ship that employed the stardrive, was familiar with instruments which controlled it, had been schooled in their use. A detailed investigation of his memories could not fail to provide literally hundreds of meaningful clues. And the Machine's scientist's, in their superficially still fruitless search for the nature of the drive, had, in fact, covered basic possibilities with such comprehensive thoroughness that a few indisputably valid clues would show them now what it *must* be.

The prisoner, still demonstrating an extraordinary degree of obliviousness to what lay in store for him, appeared to welcome the opportunity to be heard by the directors of the Machine. Menesee, leaning back in his chair, studied the man thoughtfully, giving only partial attention to what was said. This was the standard opening stage of a Tribunal interrogation, an underplayed

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exchange of questions and answers. Innocuous as it seemed, it was part of a procedure which had become refined almost to an unvarying ritual—a ritual of beautiful and terrible precision which never failed to achieve its goals. Every man watching and listening in the Machine's auditoriums across the world was familiar with the swift processes by which a normal human being was transformed into a babbling puppet, his every significant thought becoming available for the upper echelons to regard and evaluate.

They would, of course, use torture. It was part of the interlocking mechanisms of interrogation, no more to be omitted than the preliminary conditioning by drug and hypnosis. Menesee was not unduly squeamish, but he felt some relief that it would not be the crude instruments ranked beside the prisoner which would be used. They were reserved as a rule for offending members of the organization, providing a salutary warning for any others who might be tempted to act against the interests of the Machine or fail culpably in their duties. This prisoner, as an individual, meant nothing to the Machine. He was simply a source of valuable information. Therefore, only direct nerve stimulation would be employed, in the manipulation of which Spokesman Dorn was a master.

So far the Spokesman had restricted himself to asking the prisoner questions, his voice and manner gravely courteous. To Menesee's surprised interest, he had just inquired whether two men of the last Earth ship to visit Mars, who had disappeared there, might not have been captured by Mars Convicts operating secretly within the Solar System.

"Yes, sir," Rainbolt replied readily, "they were. I'm happy to say that they're still alive and well."

Menesee recalled the incident now. After the mass escape of the Mars Convicts the penal settlements had been closed down and the mining operations abandoned. To guard the desert planet against FTL raiders as Earth was guarded was technically infeasible. But twice each decade a patrol ship went there to look for signs that the Mars Convicts had returned. The last of these patrols had been conducted two years before. The missing men were believed to have been inspecting a deserted settlement in a ground vehicle when they vanished, but no trace of them or the vehicle could be discovered.

Administrator Bradshaw, seated to the spokesman's left, leaned forward as if to speak, but then sat back again. Menesee thought that Rainbolt's blunt admission had angered him. Bradshaw, white-haired and huge in build, had been for many years the nominal head of the Machine; but in practice the powers of the administrator were less than those of the spokesman, and it would have been a breach of protocol for Bradshaw to intervene in the interrogation.

Dorn appeared to have noticed nothing. He went on. "What was the reason for capturing these men?"

"It was necessary," Rainbolt explained, "to find out what the conditions on Earth were like at present. At the time we didn't want to risk discovery by coming too close to Earth itself. And your two men were able to tell us all we needed to know."

"What was that?" the spokesman asked.

Rainbolt was silent a moment, then said, "You see, sir, most of the past sixty years have been spent in finding new worlds on which human beings can live without encountering too many difficulties. But then—"

Dorn interrupted quietly, "You found such worlds?"

"Yes, sir, we did," Rainbolt said. "We're established, in about equal numbers, on planets of three star systems. Of course, I'm not allowed to give you more precise information on that at present."

"Quite understandable," the spokesman agreed dryly.

Menesee was conscious of a stir of intense interest among the listening directors in the hall. This was news, indeed! Mingled with the interest was surprised amusement at the prisoner's artless assumption that he had any choice about what he would or would not tell.

"But now that we're established," Rainbolt went on, apparently unaware of the sensation he had created, "our next immediate concern is to resume contact with Earth. Naturally, we can't do that freely while your Machine remains in political control of the planet. We found out from the two captured men that it still is in control. We'd hoped that after sixty years government in such a form would have become obsolete here."

Mensee heard an astonished murmuring from the director boxes on his right, and felt himself that the fellow's impudent last remark might well have been answered by a pulse of nerve stimulation. Spokesman Dorn, however, replied calmly that the Machine happened to be indispensable to Earth. A planetary economy, and one on the verge of becoming an interplanetary and even interstellar economy, was simply too intricate and precariously balanced a structure to maintain itself without the assistance of a very tightly organized governing class.

"If the Machine were to vanish today," he explained, "Earth would approach a state of complete chaos before the month was out. In a year, a billion human beings would be starving to death. There would be fighting . . . wars—" He shrugged. "You name it. No, my friend, the Machine is here to stay. And the Mars Convicts may as well resign themselves to the fact."

Rainbolt replied earnestly that he was not too well informed in economics, that not being his field. However, he had been told and believed that while the situation described by the spokesman would be true today, it should not take many years to train the populations of Earth to run their affairs quite as efficiently as the Machine had done, and without loss of personal and political liberties.

At any rate, the Mars Convicts and their descendants

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did not intend to give up the independence they had acquired. On the other hand, they had two vital reasons for wanting to come to an agreement with Earth. One was that they might waste centuries in attempting to accomplish by themselves what they could now do immediately if Earth's vast resources were made available to them. And the other, of course, was the obvious fact that Earth would not remain indefinitely without a stardrive of its own. If an unfriendly government was in control when it obtained one, the Mars Convicts would be forced either to abandon their newly settled planets and retreat farther into the galaxy or submit to Earth's superior strength.

Meanwhile, however, they had developed the principles of Oneness. Oneness was in essence a philosophy, but it had many practical applications; and it was in such practical applications that he, Rainbolt, was a trained specialist. He had, therefore, been dispatched to Earth to introduce the principles, which would in time bring about the orderly disintegration of the system of the Machine, to be followed by the establishment of an Earth government with which the Mars Convicts could deal without detriment to themselves.

Menesee had listened with a sense of growing angry incredulity. The fellow couldn't be as much of a fool as he seemed! Therefore, he had devised this hoax after he realized he would be captured, to cover up his real purpose which could only be that of a spy. Menesee saw that Administrator Bradshaw was saying something in a low voice to the spokesman, his face stony. Dorn glanced over at him, then looked back at the prisoner and said impassively, "So the goal of your missionary work here is the disintegration of the Machine?"

Rainbolt nodded, with an air almost of eagerness. "Yes, sir, it is! And if I will now be permitted to—"

"I am afraid you will be permitted to do nothing," Spokesman Dorn said dryly, "except, of course, to answer the number of questions we intend to ask you."

"But, sir I—"

Rainbolt checked himself, looking startled. The spokesman's hand had moved very slightly on the desk before him, and Rainbolt had just had his first experience with direct nerve stimulation. He stood kneading his right hand with his left, staring up at the spokesman, mouth half open.

Menesee smiled in grim amusement. It would have been a low-level pulse, of course; but even a low-level pulse, arriving unexpectedly, was a very unpleasant surprise. He had foreseen the spokesman's action, had, in fact, felt a sympathetic imaginary twinge in his own right hand as the pulse reached the prisoner.

Rainbolt swallowed, said in a changed voice, "Sir, we heard from the two captured men that the Machine has retained its practice of torture during interrogations. It isn't necessary to convince me that you are serious about this. Do the questions you referred to have to do with the stardrive?"

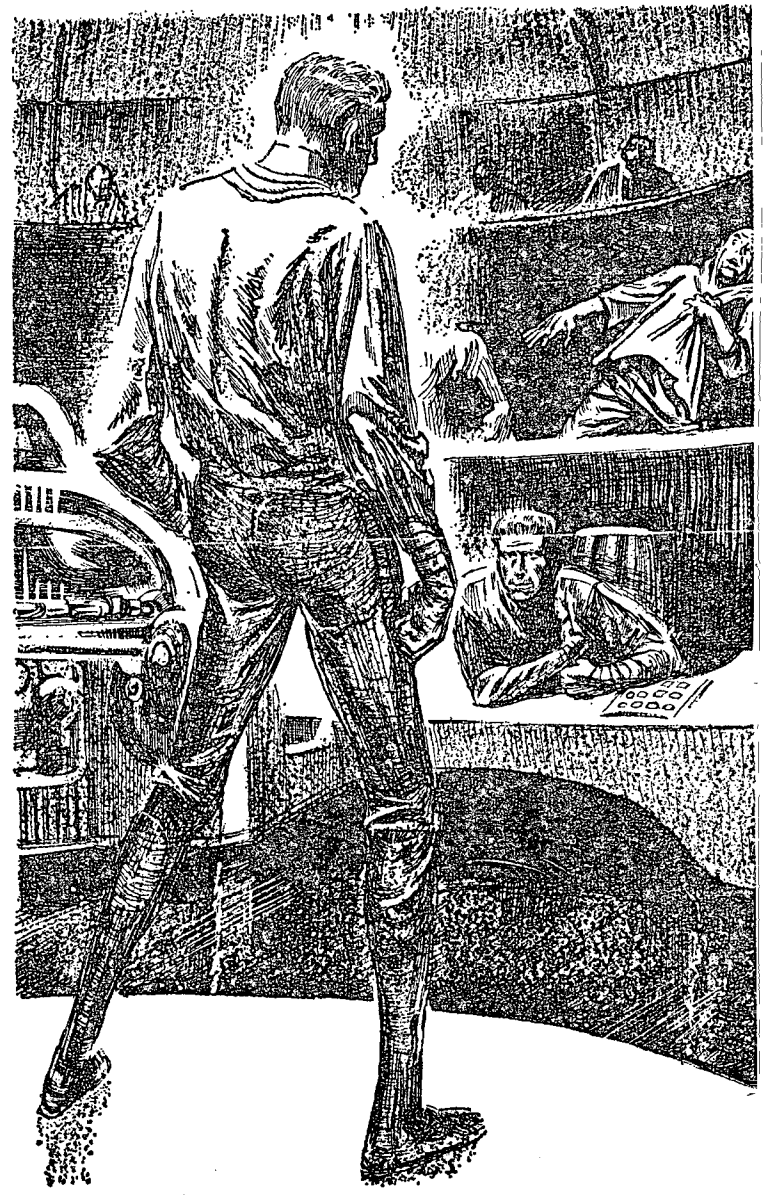
The spokesman nodded. "Of course."

Rainbolt said stubbornly, "Then, sir, it can do you no good at all to torture me. I simply don't have such information. We do plan to make the stardrive freely available to Earth. But not while Earth is ruled by the organization of the Machine."

This time, Menesee did not observe the motion of the spokesman's hand. Instead he saw Rainbolt jerk violently to the right. At the same moment, a blast of intense, fiery, almost unbearable pain shot up his own arm. As he grasped his arm, sweat spurting out on his face, he heard screams from the box on his left and realized it was Director Cornelius who screamed.

There were answering screams from around the hall. Then the pain suddenly subsided.

Menesee stared about, breathing raggedly. The pain-



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reaction had been severe enough to affect his vision; the great hall looked momentarily darker than it should have been. And although the actual pain had ended, the muscles of his right arm and shoulder were still trying to cramp into knots.

There was no more screaming. From the right came Director Ojeda's gasping voice. "What happened? Did something go wrong with the stimulating devices? We might all have been killed—!"

Menesee didn't reply. Wherever he looked, he saw faces whitened with shock. Apparently everyone in the Tribunal Hall, from the administrator and Spokesman Dorn on down to the directors' attendants and the two guards flanking the prisoner's area, had felt the same thing. Here and there, men who had collapsed were struggling awkwardly back to their feet. He heard a hoarse whisper behind him. "Sir, Director Cornelius appears to have fainted!"

Menesee glanced around, saw Cornelius' attendant behind the box, then Cornelius himself, slumped forward, face down and motionless, sprawling half across his table. "Let him lie there and keep quiet, fool!" Menesee ordered the man sharply. He returned his attention to the center of the hall as Spokesman Dorn announced in a voice which held more of an edge than was normal but had lost none of its strength and steadiness, "Before any moves are suggested, I shall tell you what has been done.

"The Tribunal Hall has been sealed and further events in it will be monitored from without. No one will be able to leave until the matter with which we are now concerned here has been settled to the satisfaction of the Machine.

"Next, any of you who believe that an instrument failure was involved in the experience we shared can disabuse themselves. The same effect was reported immediately from two other auditoriums on the Great Circuit, and it is quite possible that it was repeated in all of them."

Rainbolt, grimacing and massaging his right arm vigorously, nodded. "It *was* repeated in all of them, sir!"

The spokesman ignored him, went on. "The Tribunal Hall has, therefore, been cut out of the Grand Assembly Circuit. How circuit energies could have been employed to transmit such physical sensations is not clear. But they will not be used in that manner again."

Menesee felt a flash of admiration. His own thoughts had been turning in the same direction, but he couldn't have approached Spokesman Dorn's decisive speed of action.

Dorn turned his attention now to Rainbolt. "What happened," he said, "apparently was caused by yourself."

Rainbolt nodded. "Yes, sir. It was. It was an application of Oneness. At present, I'm acting as a focal point of Oneness. Until that condition is changed, whatever I experience here will be simultaneously experienced by yourselves."

Menesee thought that the effects of the Machine's discipline became splendidly apparent at that point. No one stirred in the great hall though it must have been obvious to every man present that Rainbolt's words might have doomed them along with himself.

Rainbolt went on, addressing Spokesman Dorn.

"There is only one mistake in your reasoning, sir. The demonstrated effect of Oneness is not carried by the energies of the Grand Assembly Circuit, though I made use of those energies in establishing an initial connection with the other auditoriums and the people in them.

"You see, sir, we learned from the two men captured on Mars about your practice of having the two highest echelons of your organization attend significant hearings in the Tribunal Hall through the Assembly Circuit. Our plan was based on that. We knew that if anything was to be accomplished with the Oneness principles on Earth, it would have to be through a situation in which they could be applied simultaneously to the entire leadership of the Machine. That has now been done, and the fact that you had the Tribunal Hall taken out of the Assembly Circuit did not change the Oneness contact. It remains in full effect."

Spokesman Dorn stared at him for an instant, said, "We can test the truth of that statement immediately, of course; and we shall!" His hand moved on the desk.

Menesee felt pain surge through his left arm. It was not nearly as acute a sensation as the previous pulse had been, but it lasted longer—a good ten seconds. Menesee let his breath out carefully as it again ebbed away.

He heard the spokesman saying, "Rainbolt's claim appears to be verified. I've received a report that the pulse was being experienced in one of the auditoriums . . . and, yes . . . now in several."

Rainbolt nodded. "It was a valid claim, believe me, sir!" he said earnestly. "The applications of our principles have been very thoroughly explored, and the effects are invariable. Naturally, our strategem would have been useless if I'd been able to maintain contact only long enough to provide you with a demonstration of Oneness. Such a contact *can* be broken again, of course. But until I act deliberately to break it, it maintains itself automatically.

"To make that clear, I should explain that distance, direction and intervening shielding materials do not change the strength of the contact. Distance at least does not until it is extended to approximately fifty thousand miles."

"And what happens then?" the spokesman asked, watching him.

"At that point," Rainboolt acknowledged, "Oneness contacts do become tenuous and begin to dissolve." He

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added, almost apologetically, "However, that offers you no practical solution to your problem."

"Why not?" Dorn asked. He smiled faintly. "Why shouldn't we simply lock you into a spaceship and direct the ship through the defense fields and out into the solar system on automatic control?"

"I sincerely hope you don't try it, sir! Experiments in dissolving contacts in that manner have been invariably fatal to all connected individuals."

The spokesman hesitated. "You and every member of the Machine with whom you are now in contact would die togther if that were done?"

"Yes, sir. That is certain what the results of those experiments show."

Administrator Bradshaw, who had been staring coldly at Rainbolt, asked in a hard, flat voice, "If you do nothing to break the contact, how long will this situation continue?"

Rainbolt looked at him. "Indefintely, sir," he said. "There is nothing I need to do about it. It is a static condition."

"In that case," Bradshaw said icily, "*this* should serve to break the contact through you!"

As his hand came up, leveling a gun, Menesee was half out of his chair, hands raised in alarmed protest. "Stop him!" Menesee shouted.

But Administrator Bradshaw already was sagging sideways over the armrest of his chair, head lolling backwards. The gun slid from his hand, dropped to the platform.

"Director Menesee," Dorn said coolly from beside Bradshaw, "I thank you for your intended warning! Since the administrator and the spokesman are the only persons permitted to bear arms in the Tribunal Hall, I was naturally prepared to paralyze Administrator Bradshaw if he showed intentions of resorting to thoughtless action." He looked down at Rainbolt. "Are Director Menesee and I correct in assuming that if you died violently the persons with whom you are in contact would again suffer the same experience?"

"Yes, sir," Rainbolt said. "That is implicit in the principles of Oneness." He shrugged. "Under most circumstances, it is a very undesirable effect. But here we have made use of it—"

"The situation," Spokesman Dorn told the directors in the Tribunal Hall some minutes later, "is then this. There has been nothing haphazard about the Mars Convicts' plan to coerce us into accepting their terms. Considering the probable quality of the type of minds which developed both the stardrive and the extraordinary 'philosophy' we have encountered today, that could be taken for granted from the start. We cannot kill their emissary here, or subject him to serious pain or injury, since we would pay a completely disproportionate penalty in doing it.

"However, that doesn't mean that we should surrender to the Mars Convicts. In fact, for all their cleverness, they appear to be acting out of something very close to desperation. They have gained no essential advantage through their trick, and we must assume they made the mistake of underestimating us. This gentleman they sent to Earth has been given thorough physical examinations. They show him to be in excellent health. He is also younger by many years than most of us.

"So he will be confined to quarters where he will be comfortable and provided with whatever he wishes . . . but where he will not be provided with any way of doing harm to himself. And then, I believe, we can simply forget about him. He will receive the best of attention, including medical care. Under such circumstances, we can expect his natural life span to exceed our own.

"Meanwhile, we shall continue our program of developing our own spacedrive. As the Mars Convicts themselves foresee, we'll gain it eventually and will then be more than a match for them. Until then the defense fields around Earth will remain closed. No ship will leave Earth and no ship will be admitted to it. And in the long run we will win."

The spokesman paused, added, "If there are no other suggestions, this man will now be conducted to the hospital of the Machine where he is to be detained for the remainder of his days."

Across the hall from Menesee, a figure arose deliberately in one of the boxes. A heavy voice said, "Spokesman Dorn, I very definitely do have a suggestion."

Dorn looked over, nodded warily. "Go ahead, Director Squires!"

Menesee grimaced in distaste. He had no liking for Squires, a harsh, arrogant man, notorious for his relentless persecution of any director or officer who, in Squires' opinion, had become slack in his duties to the Machine. But he had a large following in the upper echelons, and his words carried weight.

Squires folded his arms, said unhurriedly as if savoring each word, "As you pointed out, Spokesman Dorn, we cannot hurt the person of this prisoner. His immediate accomplices also remain beyond our reach at present. However, our hands are not—as you seem to imply—so completely tied that we cannot strike back at these rascals at once. There are camps on Earth filled with people of the same political stripe—potential supporters of the Mars Convicts who would be in fullest sympathy with their goals if they learned of them.

"I suggest that these people serve now as an object lesson to show the Mars Convicts the full measure of our determination to submit to no threats of force! Let this prisoner and the other convicts who doubtless are lurking in nearby space beyond Earth's defense fields know that *for every day* their obscene threat against the high officers of the Machine continues hundreds of malcontents who would welcome them on Earth will be painfully executed! Let them—"

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Pain doubled Menesee abruptly over the table before him. A savage, compressing pain, very different from the fiery touch of the nerve stimulators, which held him immobile, unable to cry out or draw breath.

It relaxed almost as instantaneously as it had come on. Menesee slumped back in his chair, shaken and choking, fighting down bitter nausea. His eyes refocused painfully on Rainbolt, gray-faced but on his feet, in the prisoner's area.

"You will find," Rainbolt was saying, "that Director Squires is dead. And so, I'm very much afraid, is every other member of the upper echelons whose heart was in no better condition than his. This was a demonstration I had not intended to give you. But since it has been given, it should serve as a reminder that while it is true we could not force you directly to do as we wish, there are things we are resolved not to tolerate."

Ojeda was whispering shakily near Menesee, "He controls his body to the extent that he was able to bring on a heart attack in himself and project it to all of us! He counted on his own superb physical condition to pull him through it unharmed. *That* is why he didn't seem frightened when the administrator threatened him with a gun. Even if the spokesman hadn't acted, that gun never would have been fired.

"Menesee, no precautions we could take will stop that monster from killing us all whenever he finally chooses —simply by committing suicide through an act of will!"

Spokesman Dorn's voice seemed to answer Ojeda.

"Director Squires," Dorn's voice said, still thinned by pain but oddly triumphant, "became a victim of his own pointless vindictiveness. It was a mistake which, I am certain, no member of the Machine will care to repeat.

"Otherwise, this incident has merely served to confirm that the Mars Convicts operate under definite limitations. They *could* kill us but can't afford to do it. If they are to thrive in space, they need Earth and Earth's resources. They are aware that if the Machine's leadership dies, Earth will lapse into utter anarchy and turn its tremendous weapons upon itself.

"The Mars Convicts could gain nothing from a ruined and depopulated planet. Therefore, the situation as it stands remains a draw. We shall devote every effort to turn it into a victory for us. The agreement we come to eventually with the Mars Convicts will be on our terms—and there is still essentially nothing they or this man, with all his powers, can do to prevent it."

The Missionary of Oneness swung his bronzed, well-muscled legs over the side of the hammock and sat up. With an expression of great interest, he watched Spokesman Dorn coming across the sun room towards him from the entrance corridor of his hospital suite. It was the first visit he'd had from any member of the organization of the Machine in the two years he had been confined here.

For Spokesman Dorn it had been, to judge by his appearance, a strenuous two years. He had lost weight and there were dark smudges of fatigue under his eyes. At the moment, however, his face appeared relaxed. It might have been the relaxation a man feels who has been emptied out by a hard stint of work, but knows he has accomplished everything that could possibly have been done.

Dorn came to a stop a dozen feet from the hammock. For some seconds, the two men regarded each other without speaking.

"On my way here," Dorn remarked then, "I was wondering whether you mightn't already know what I've come to tell you."

Rainbolt shook his head.

"No," he said. "I think I could guess what it is—I pick up generalized impressions from outside—but I don't really know."

Spokesman Dorn considered that a moment, chewing his lower lip reflectively. Then he shrugged.

"So actual mind-reading doesn't happen to be one of your talents," he said. "I was rather sure of that, though others had a different opinion. Of course, considering what you are able to do, it wouldn't really make much difference.

"Well . . . this morning we sent out a general call by space radio to any Mars Convict ships which might be in the Solar System to come in. The call was answered. Earth's defense fields have been shut down, and the first FTL ships will land within an hour."

"For what purpose?" Rainbolt said curiously.

"There's a strong popular feeling," Spokesman Dorn said, "that your colleagues should take part in deciding what pattern Earth's permanent form of government will take. In recent months we've handled things in a rather provisional and haphazard manner, but the situation is straightened out well enough now to permit giving attention to such legalistic details. Incidentally, you will naturally be free to leave when I do. Transportation is available for you if you wish to welcome your friends at the spaceport."

"Thank you," said Rainbolt. "I believe I will."

Spokesman Dorn shrugged. "What could we do?" he said, almost disinterestedly. "You never slept. In the beginning you were drugged a number of times, as you probably know, but we soon discovered that drugging you seemed to make no difference at all."

"It doesn't," Rainbolt agreed.

"Day after day," Dorn went on, "we'd find thoughts and inclinations coming into our minds we'd never wanted there. It was an eerie experience—though personally I found it even more disconcerting to awaken in the morning and discover that my attitudes had changed in some particular or other, and as a rule changed irrevocably."

Rainbolt said, "In a sense, those weren't really your attitudes, you know. They were results of the condi-

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tioning of the Machine. It was the conditioning I was undermining."

"Perhaps it was that," Dorn said. "It seems to make very little difference now." He paused, frowned. "When the first talk of initiating changes began in the councils, there were numerous executions. I know now that we were badly frightened men. Then those of us who had ordered the executions found themselves wanting similar changes. Presently we had a majority, and the changes began to be brought about. Reforms, you would call them—and reforms I suppose they actually were. There was considerable general disturbance, of course, but we retained the organization to keep that within reasonable bounds."

"We expected that you would," Rainbolt said.

"It hasn't really been too bad," Spokesman Dorn said reflectively. "It was simply an extraordinary amount of work to change the structure of things that had been imposed on Earth by the Machine for the past century and a half. And the curious part of it is, you know, that now it's done we don't even feel resentment! We actually wouldn't want to go back to what we had before. You've obtained an incredible hold on our minds—and frankly I expect that when at last you do relinquish your control, we'll commit suicide or go mad."

Rainbolt shook his head. "There's been just one mistake in what you've said," he remarked.

Spokesman Dorn looked at him with tired eyes. "What's that?" he asked.

"I said I was undermining the conditioning of the Machine. I did—and after that I did nothing. You people simply have been doing what most of you always would have preferred to do, Spokesman. I relinquished control of the last of you over six months ago." ■

THE ANALYTICAL LABORATORY

Our authors, even more than the readers, dislike to have our An Lab reports delayed. After all, the "Who gets the bonus?" question is settled by your reader votes, as published here in the Lab—and under ANALOG's system, the bonus is not limited to kudos alone; you readers vote a story into first place—that author gets an extra cent a word. (And second place gets an extra ½¢ a word.)

But we've been delayed by the problems of the new format, and resultant unfamiliarity with how to assemble this lead-tin-antimony alloy jig-saw puzzle. So now we're catching up with three An-Lab:

PLACE	STORY	AUTHOR	POINTS
	JANUARY 1963		
1.	Space Viking (Pt. 3)	H. Beam Piper	1.85
2.	The Hard Way	Gordon Dickson	2.00
3.	The Common Man	Guy McCord	2.78
4.	Philosopher's Stone	Christopher Anvil	3.07
	FEBRUARY 1963		
1.	Code Three	Rick Raphael	1.94
2.	Space Viking (Conclusion)	H. Beam Piper	2.76
3.	With No Strings Attached	David Gordon	3.10
4.	Hilifter	Gordon Dickson	3.44
5.	The Topper	Arthur Porges	3.80
6.	Something Will Turn Up	David Mason	4.13
	MARCH 1963		
1.	Frigid Fracas (Pt. 1)	Mack Reynolds	1.94
2.	Spanner in the Works	J. T. McIntosh	2.04
3.	Not in the Literature	Christopher Anvil	3.01
4.	The Happy Man	Gerald W. Page	3.37
5.	All Day Wednesday	Richard Olin	4.14

THE EDITOR

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EXPEDITER

His assignment was to get things done;
he definitely did so.
Not quite the things intended, perhaps,
but definitely done.

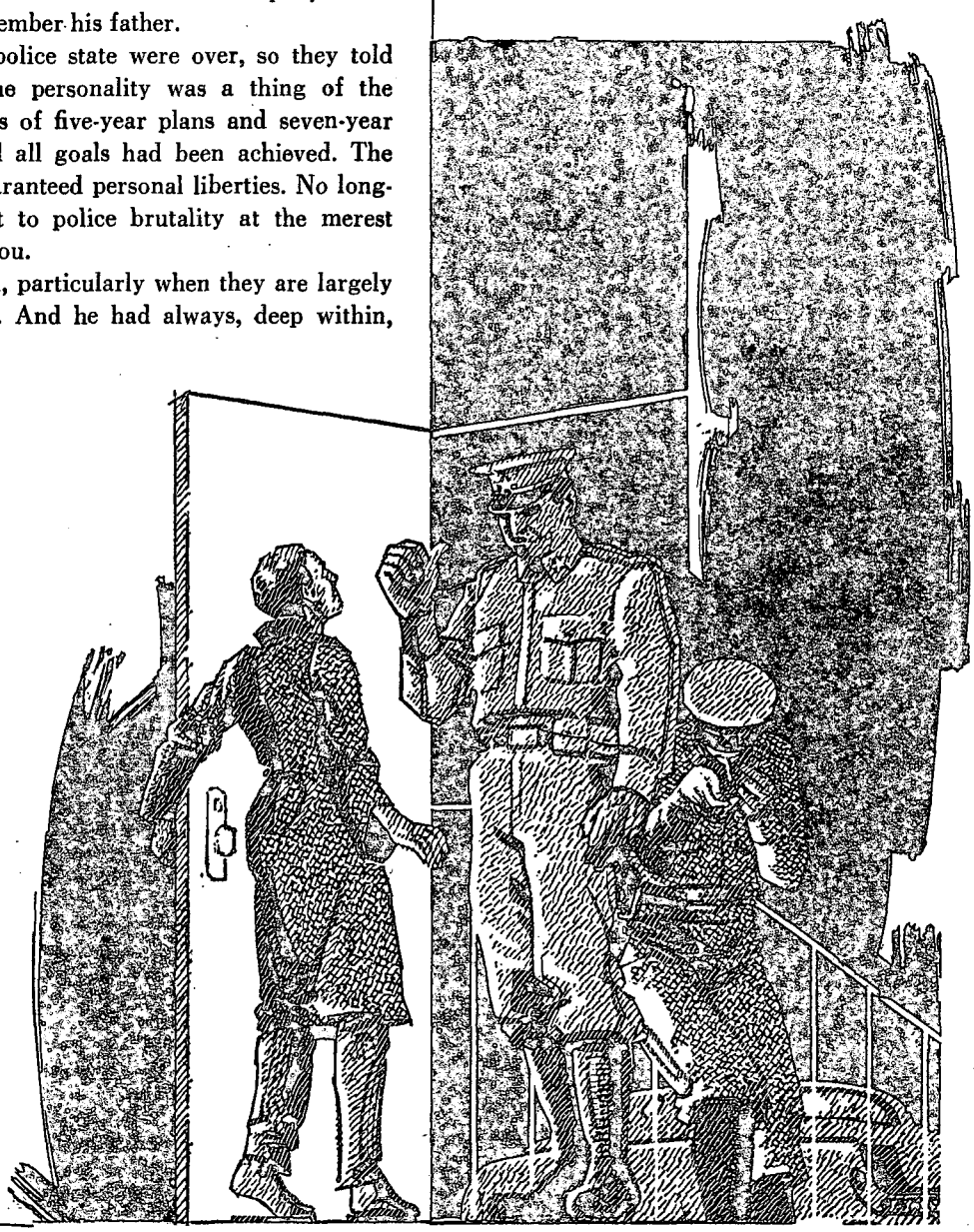
by MACK REYNOLDS

ILLUSTRATED BY GEORGE SCHELLING

The knock at the door came in the middle of the night, as Josip Pekic had always thought it would. He had been but four years of age when the knock had come that first time and the three large men had given his father a matter of only minutes to dress and accompany them. He could barely remember his father.

The days of the police state were over, so they told you. The cult of the personality was a thing of the past. The long series of five-year plans and seven-year plans were over and all goals had been achieved. The new constitution guaranteed personal liberties. No longer were you subject to police brutality at the merest whim. So they told you.

But fears die hard, particularly when they are largely of the subconscious. And he had always, deep within, expected the knock.



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He was not mistaken. The rap came again, abrupt, impatient. Josip Pekic allowed himself but one chill of apprehension, then rolled from his bed, squared slightly stooped shoulders, and made his way to the door. He flicked on the light and opened up, even as the burly, empty faced zombi there was preparing to pound still again.

There were two of them, not three as he had always dreamed. As three had come for his father, more than two decades before.

His father had been a rightist deviationist, so the papers had said, a follower of one of whom Josip had never heard in any other context other than his father's trial and later execution. But he had not cracked under whatever pressures had been exerted upon him, and of that his son was proud.

He had not cracked, and in later years, when the cult of personality was a thing of the past, his name had been cleared and returned to the history books. And now it was an honor, rather than a disgrace, to be the son of Ljubo Pekic, who had posthumously been awarded the title Hero of the People's Democratic Dictatorship.

But though his father was now a hero, Josip still expected that knock. However, he was rather bewildered at the timing, having no idea of why he was to be under arrest.

The first of the zombi twins said expressionlessly, "Comrade Josip Pekic?"

If tremor there was in his voice, it was negligible. He was the son of Ljubo Pekic. He said, "That is correct. Uh . . . to what do I owe this intrusion upon my privacy?" That last in the way of bravado.

The other ignored the question. "Get dressed and come with us, Comrade," he said flatly.

At least they still called him comrade. That was some indication, he hoped, that the charges might not be too serious.

He chose his dark suit. Older than the brown one, but in it he felt he presented a more self-possessed demeanor. He could use the quality. Five foot seven, slightly underweight and with an air of unhappy self-deprecation, Josip Pekic's personality didn't exactly dominate in a group. He chose a conservative tie and a white shirt, although he knew that currently some frowned upon white shirts as a bourgeois affectation. It was all the thing, these days, to look proletarian, whatever that meant.

The zombis stood, watching him emptily as he dressed. He wondered what they would have said had he asked them to wait in the hallway until he was finished. Probably nothing. They hadn't bothered to answer when he asked what the charge against him was.

He put his basic papers, his identity card, his student cards, his work record and all the rest in an inner pocket, and faced them. "I am ready," he said as evenly as he could make it come.

They turned and led the way down to the street and to the black limousine there. And in it was the third one, sitting in the front seat, as empty of face as the other two. He hadn't bothered to turn off the vehicle's cushion jets and allow it to settle to the street. He had known how very quickly his colleagues would reappear with their prisoner.

Josip Pekic sat in the back between the two, wondering just where he was being taken, and, above all, why. For the life of him he couldn't think of what the charge might be. True enough, he read the usual number of prescribed books, but no more than was common among other intellectuals, among the students and the country's avant garde, if such you could call it. He had attended the usual parties and informal debates in the coffee shops where the more courageous attacked this facet or that of the People's Dictatorship. But he belonged to no active organizations which opposed the State, nor did his tendencies attract him in that direction. Politics were not his interest.

At this time of the night, there was little traffic on the streets of Zagurest, and few parked vehicles. Most of those which had been rented for the day had been returned to the car-pool garages. It was the one advantage Josip could think of that Zagurest had over the cities of the West which he had seen. The streets were not cluttered with vehicles. Few people owned a car outright. If you required one, you had the local car pool deliver it, and you kept it so long as you needed transportation.

He had expected to head for the Kalemegdan Prison where political prisoners were traditionally taken, but instead, they slid off to the right at Partisan Square, and up the Boulevard of the November Revolution. Josip Pekic, in surprise, opened his mouth to say something to the security policeman next to him, but then closed it again and his lips paled. He knew where they were going, now. Whatever the charge against him, it was not minor.

A short kilometer from the park, the government buildings began. The Skupstina, the old Parliment left over from the days when Transbalkania was a backward, feudo-capitalistic power of third class. The National Bank, the new buildings of the Borba and the Politica. And finally, set back a hundred feet from the boulevard, the sullen, squat Ministry of Internal Affairs.

It had been built in the old days, when the Russians had still dominated the country, and in slavish imitation of the architectural horror known as Stalin Gothic. Meant to be above all efficient and imposing and winding up simply—grim.

Yes. Josip Pekic knew where they were going now.

The limousine slid smoothly on its cushion of air, up the curved driveway, past the massive iron statue of the worker struggling against the forces of reaction, a rifle in one hand, a wrench in the other and stopped before, at last, the well-guarded doorway.

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Without speaking, the two police who had come to his room opened the car door and climbed out. One made a motion with his head, and Josip followed. The limousine slid away immediately.

Between them, he mounted the marble stairs. It occurred to him that this was the route his father must have taken, two decades before.

He had never been in the building of the Ministry of Internal Affairs, before. Few Transbalkanians had, other than those who were employed in the MVD, or who came under the Ministry's scrutiny.

Doors opened before them, closed behind them. Somewhat to Josip Pekic's surprise the place was copiously adorned with a surplus of metal and marble statues, paintings and tapestries. It had similarities to one of Zagurest's heavy museums.

Through doors and down halls and through larger rooms, finally to a smaller one in which sat alone at a desk a lean, competent and assured type who jittered over a heavy sheaf of papers with an electro-marking computer pen. He was nattily and immaculately dressed and smoked his cigarette in one of the small pipelike holders once made *de riguer* through the Balkans by Marshal Tito.

The three of them came to a halt before his desk and, at long last, expression came to the faces of the zombis. Respect, with possibly an edge of perturbation. Here, obviously, was authority.

He at the desk finished a paper, tore it from the sheaf, pushed it into the maw of the desk chute from whence it would be transported to the auto-punch for preparation for recording. He looked up in busy impatience.

Then, to Josip Pekic's astonishment, the other came to his feet quickly, smoothly and with a grin on his face. Josip hadn't considered the possibility of being grinned at in the Ministry of Internal Affairs.

"Aleksander Kardelj," he said in self-introduction, sticking out a lean hand to be shaken. "You're Pekic, eh? We've been waiting for you."

Josip shook, bewildered. He looked at the zombi next to him, uncomprehendingly.

He who had introduced himself, darted a look of comprehension from Josip to the two. He said disgustedly, but with mild humor oddly mixed, "What's the matter, did these hoodlums frighten you?"

Josip fingered his chin nervously. "Of course not."

One of the zombis shifted his feet. "We did nothing except obey orders."

Kardelj grimaced in sour amusement. "I can imagine," he grunted. "Milka, you see too many of these imported Telly shows from the West. I suspect you see yourself as a present day Transbalkanian G-Man."

"Yes, Comrade," Milka said, and then shook his head.

"Oh, hush up and get out," Kardelj said. He flicked the cigarette butt from its holder with a thumb and took up a fresh one from a desk humidor and wedged it into the small bowl. He looked at Josip and grinned again, the action giving his face an unsophisticated youthful expression.

"You can't imagine how pleased I am to meet you, at last," he said. "I've been looking for you for months."

Josip Pekic ogled him blankly. The name had come through to him at last. Aleksander Kardelj was seldom in the news, practically never photographed, and then in the background in a group of Party functionaries, usually with a wry smile on his face. But he was known throughout the boundaries of the State, if not internationally. Aleksander Kardelj was Number Two. Right-hand man of Zoran Jankez himself, second in command of the Party and rumored to be the brains behind the throne.

The zombis had gone, hurriedly.

"Looking for me?" Josip said blankly. "I haven't been in hiding. You've made some mistake. All I am is a student of—"

"Of course, of course," Kardelj said, humorously impatient. He took up a folder from his desk and shook it absently in Josip's general direction. "I've studied your dossier thoroughly." He flicked his eyes up at a wall clock. "Come along. Comrade Jankez is expecting us. We'll leave explanations until then."

In a daze, Josip Pekic followed him.

Comrade Jankez, Number One. Zoran Jankez, Secretary General of the Party. President of the U.B.S.R., the United Balkan Soviet Republics. Number One.

Josip could hardly remember so far back that Zoran Jankez wasn't head of the Party, when his face, or sculptered bust, wasn't to be seen in every store, on the walls of banks, railroad stations, barber shops, or bars. Never a newsreel but that part of it wasn't devoted to Comrade Jankez, never a Telly newscast but that Number One was brought to the attention of the viewers. His coming to power had been a quiet, bloodless affair upon the death of the Number One who had preceded him, and he had remained in his position for a generation.

Josip Pekic followed Aleksander Kardelj in a daze, through a door to the rear of the desk, and into a somewhat bigger room, largely barren of furniture save for a massive table with a dozen chairs about it. At the table, looking some ten years older than in any photo Josip had ever seen, sat Zoran Jankez.

He looked ten years older, and his face bore a heavy weariness, a grayness, that never came through in his publicity shots. He looked up from a report he was perusing and grunted a welcome to them.

Kardelj said in pleasurable enthusiasm, "Here he is, Zoran. Our Comrade Josip Pekic. The average young citizen of Transbalkania."

Number One grunted again, and took in the less than imposing figure of Josip Pekic. Josip felt an urge to nibble at his fingernails, and repressed it. He had recently broken himself of the smoking habit and was hard put to find occupation for his hands when nervous.

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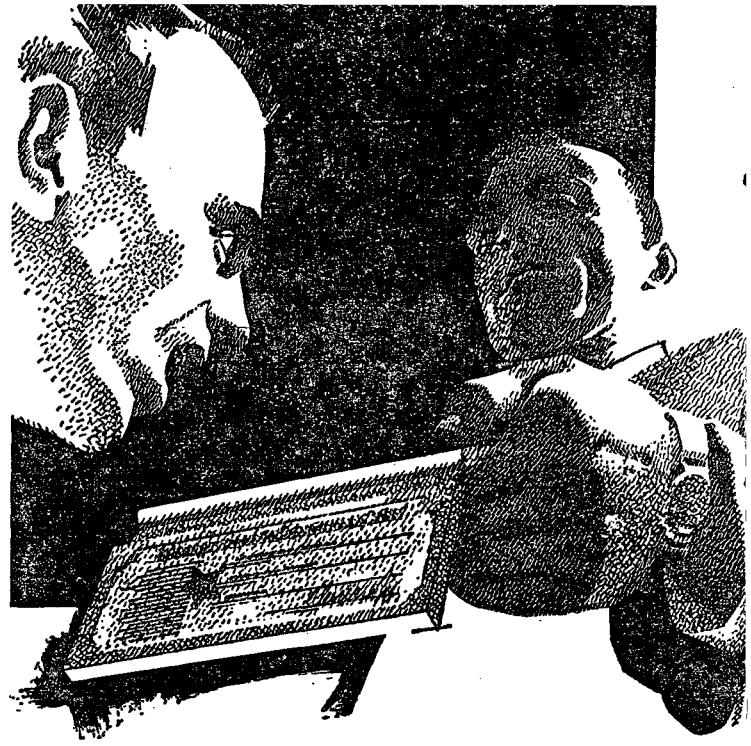

Zoran Jankez growled an invitation for them to be seated and Kardelj adjusted his trousers to preserve the crease, threw one leg up along the heavy conference table, and rested on a buttock, looking at ease but as though ready to take off instantly.

Josip fumbled himself into one of the sturdy oaken chairs, staring back and forth at the two most powerful men of his native land. Thus far, no one had said anything that made any sense whatsoever to him since he had been hauled from his bed half an hour ago.

Zoran Jankez rasped, "I have gone through your dossier, Comrade. I note that you are the son of Hero of the People's Democratic Dictatorship, Ljubo Pekic."

"Yes, Comrade Jankez," Josip got out. He fussed with his hands, decided it would be improper to stick them in his pockets.

Number One grunted. "I knew Ljubo well. You must realize that his arrest was before my time. I had no power to aid him. It was, of course, after my being elected to the Secretary Generalship that he was exonerated and his name restored to the list of those who have gloriously served the State. But then, of course, you bear no malice at this late date. Ljubo has been posthumously given the hero's award."

It wasn't exactly the way Josip knew the story, but there was little point in his objecting. He simply nodded. He said, unhappily, "Comrades, I feel some mistake has been made. I . . . I have no idea—"

Kardelj was chuckling, as though highly pleased with some development. He held up a hand to cut Josip short and turned to his superior. "You see, Zoran. A most average, laudable young man. Born under our regime, raised under the People's Democratic Dictatorship. Exactly our man."

Zoran Jankez seemed not to hear the other He was studying Josip heavily, all but gloomily.

A beefy paw went out and banged a button inset in the table and which Josip had not noticed before. Almost instantly a door in the rear opened and a white-jacketed servant entered, pushing a wheeled combination bar and hors d'oeuvres cart before him. He brought the lavishly laden wagon to within reach of the heavy-set Party head, his face in servile expressionlessness.

Jankez grunted something and the waiter, not quite bowing and scraping, retreated again from the room. Number One's heavy lips moved in and out as his eyes went over the display.

Kardelj said easily, "Let me, Zoran." He arose and brought a towel-wrapped bottle from a refrigerated bucket set into the wagon, and deftly took up a delicate three-ounce glass which he filled and placed before his superior. He took up another and raised his eyebrows at Josip Pekic who shook his head—a stomach as queasy as his wasn't going to be helped by alcohol. Kardelj poured a short one for himself and resumed his place at the heavy conference table.

Jankez, his eyes small and piggish, took up a heavy slice of dark bread and ladled a full quarter pound of Danube caviar upon it. He took up the glass and tossed the chilled spirits back over his palate, grunted and stuffed the open sandwich into his mouth.

Josip's eyes went to the hors d'oeuvres wagon. The spread would have cost him six months' income.

Number One rumbled, his mouth full, "Comrade, I am not surprised at your confusion. We will get to the point immediately. Actually, you must consider yourself a very fortunate young man." He belched, took another huge bite, then went on. "Have you ever heard the term, expediter?"

"I . . . I don't know . . . I mean think so, Comrade Jankez."

The party head poured himself some more of the yellow spirits and took down half of it. "It is not important," he rasped. "Comrade Kardelj first came upon the germ of this project of ours whilst reading of American industrial successes during the Second World War. They were attempting to double, triple, quadruple their production of such war materiel as ships and aircraft in a matter of mere months. Obviously, a thousand bottlenecks appeared. All was confusion. So they resorted to expediters. Extremely competent efficiency engineers whose sole purpose was to seek out such bottlenecks and eliminate them. A hundred aircraft might be kept from completion by the lack of a single part. The expediter found them though they be as far away as England, and flew them by chartered plane to California. A score of top research chemists might be needed for a certain project in Tennessee, the expediter located them, though it meant the stripping of valued men from jobs of lesser importance. I need give no further examples. Their powers were sweeping. Their expense accounts unlimited. Their successes unbelievable." Number One's

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eyes went back to the piles of food, as though he'd grown tired of so much talk.

Josip fidgeted, still uncomprehending.

While the Party leader built himself a huge sandwich of Dalmatian ham and *pohovano pile* chicken, Aleksander Kardelj put in an enthusiastic word. "We're adapting the idea to our own needs, Comrade. You have been selected to be our first expediter."

If anything, Josip Pekic was more confused than ever. "Expediter," he said blankly. "To . . . to expedite *what?*"

"That is for you to decide," Kardelj said blithely. "You're our average Transbalkanian. You feel as the average man in the street feels. You're our what the Yankees call, Common Man."

Josip said plaintively, "You keep saying that, but I don't know what you mean, Comrade. Please forgive me, perhaps I'm dense, but what is this about me being uh, the average man? There's nothing special about me. I . . ."

"Exactly," Kardelj said triumphantly. "There's nothing special about you. You're the average man of all Transbalkania. We have gone to a great deal of difficulty to seek you out."

Number One belched and took over heavily. "Comrade, we have made extensive tests in this effort to find our average man. You are the result. You are of average age, of average height, weight, of education, and of intelligence quotient. You finished secondary school, worked for several years, and have returned to the university where you are now in your second year. Which is average for you who have been born in your generation. Your tastes, your ambitions, your . . . dreams, Comrade Pekic, are either known to be, or assumed to be, those of the average Transbalkanian." He took up a rich baklava dessert, saturated with honey, and devoured it.

Josip Pekic and his associates had wondered at some of the examinations and tests that had been so prevalent of recent date. He accepted the words of the two Party leaders. Very well, he was the average of the country's some seventy million population. Well, then?

Number One had pushed himself back in his chair, and Josip was only mildly surprised to note that the man seemed considerably paunchier than his photos indicated. Perhaps he wore a girdle in public.

Zoran Jankez took up a paper. "I have here a report from a journalist of the West who but recently returned from a tour of our country. She reports, with some indignation, that the only available eyebrow pencils were to be found on the black market, were of French import, and cost a thousand dinars apiece. She contends that Transbalkanian women are indignant at paying such prices."

The Party head looked hopelessly at first Josip and then Kardelj. "What is an eyebrow pencil?"

Kardelj said, a light frown on his usually easy-going face, "I believe it is a cosmetic."

"You mean like lipstick?"

Josip took courage. He flustered. "They use it to darken their eyebrows—women, I mean. From what I understand, it comes and goes in popularity. Right now, it is ultra-popular. A new, uh, fad originating in Italy, is sweeping the West."

Number One stared at him. "How do you know all that?" he rasped.

Josip fiddled with the knot of his tie, uncomfortably. "It is probably in my dossier that I have journeyed abroad on four occasions. Twice to International Youth Peace Conferences, once as a representative to a Trades Union Convention in Vienna, and once on a tourist vacation guided tour. On those occasions I . . . ah . . . met various young women of the West."

Kardelj said triumphantly, "See what I mean, Zoran? This comrade is priceless."

Jankez looked at his right-hand man heavily. "Why, if our women desire this . . . this eyebrow pencil nonsense, is it not supplied them? Is there some ingredient we do not produce? If so, why cannot it be imported?" He picked at his uneven teeth with a thumbnail.

Kardelj held his lean hands up, as though in humorous supplication. "Because, Comrade, to this point we have not had expediters to find out such desires on the part of women comrades."

Number One grunted. He took up another report. "Here we have some comments upon service in our restaurants, right here in Zagurest, from an evidently widely published American travel reporter. He contends that the fact that there is no tipping leads to our waiters being surly and inefficient."

He glared up at his right-hand man. "I have never noticed when I have dined at the Sumadija or the Dva Ribara, that the waiters have been surly. And only last week I enjoyed *cigansko pecenje*, gypsy roast, followed by a very flaky cherry *strudla*, at the Gradski Podrum. The service was excellent."

Kardelj cleared his throat. "Perhaps you receive better service than the average tourist, Zoran."

Jankez growled, "The tourist trade is important. An excellent source of hard currencies." He glowered across at Josip. "These are typical of the weaknesses you must ferret out, Comrade."

He put the reports down with a grunt. "But these are comparatively minor. Last week a truck driver attached to a meat-packing house in Belbrovnik was instructed to deliver a load of frozen products to a town in Macenegro. When he arrived there, it was to find they had no refrigeration facilities. So he unloaded the frozen meat on a warehouse platform and returned to Belbrovnik. At this time of the year, obviously in four hours the meat was spoiled." He glowered at Kardelj and then at Josip Pekic. "Why do things like this continually happen? How can we overtake the United States of the

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Americas and Common Europe, when on all levels our workers are afraid to take initiative? That truck driver fulfilled his instructions. He delivered the meat. He washed his hands of what happened to it afterward. Why, Comrades? Why did he not have the enterprise to preserve his valuable load, even, if necessary, make the decision to return with it to Belbrovnik?"

He grunted heavily and settled back into his chair as though through, finished with the whole question.

Aleksander Kardelj became brisk. He said to Josip Pekic with a smile. "This is your job. You are to travel about the country, finding bottlenecks, finding shortages, ferreting out mistakes and bringing them to the attention of those in position to rectify them."

Josip said glumly, "But suppose . . . suppose they ignore my findings?"

Number One snorted, but said nothing.

Kardelj said jovially, "Tomorrow the announcements will go out to every man, woman and child in the People's Democratic Dictatorship. Your word is law. You are answerable only to Comrade Jankez and myself. No restrictions whatsoever apply to you. No laws. No regulations. We will give you identification which all will recognize, and the bearer of which can do no wrong."

Josip was flabbergasted. "But . . . but suppose I come up against some . . . well, someone high in the Party, or, well . . . some general or admiral? Some—"

Kardelj said jocularly, "You answer only to us, Comrade Pekic. Your power is limitless. Comrade Jankez did not exaggerate. Frankly, were cold statistics enough, Transbalkania has already at long last overtaken the West in per capita production. Steel, agriculture, the tonnage of coal mined, of petroleum pumped. All these supposed indications of prosperity." He flung up his hands again in his semihumorous gesture of despair. "But all these things do not mesh. We cannot find such a simple matter as . . . as eyebrow pencils in our stores, nor can we be served acceptably in our restaurants and hotels. Each man passes the buck, as the Yankees say, and no man can care less whether or not school keeps. No man wants responsibility."

Josip was aghast, all over again. "But . . . but me . . . only me. What could you expect a single person to do?"

"Don't misunderstand, Comrade," Kardelj told him with amused compassion. "You are but an experiment. If it works out, we will seek others who are also deemed potential expediters to do similar work. Now, are there any further questions?"

Josip Pekic stared miserably back and forth between the two, wondering wildly what they would say if he turned the whole thing down. His eyes lit on the dour, heavy Number One, and inwardly he shook his head. No. There was no question about that. You didn't turn down Zoran Jankez. He looked at Aleksander Kardelj, and in spite of the other's smiling face, he decided you didn't turn down Number Two, either.

Josip said carefully, "From what you say, I . . . I can override anyone in Transbalkania, except yourselves. But . . . but what if I antagonize one of you? You know . . . with something I think I find wrong?"

The second in command of the Party chuckled, even as he fitted a fresh cigarette into his curved holder. "We've provided even for that, Comrade. Fifty thousand Common Europe francs have been deposited to your account in Switzerland. At any time you feel your revelations might endanger yourself, you are free to leave the country and achieve sanctuary abroad." He chuckled whimsically again. "Given the position you will occupy, a man above all law, with the whole of the nation's resources at his disposal, I cannot imagine you wishing to leave. The Swiss deposit is merely to give you complete confidence, complete security."

Number One was radiating fury as he stalked heavily down the corridors of the Ministry of Internal Affairs. On the surface, his face displayed nothing—which meant nothing. There was simply a raging aura of trouble.

Veljko Gosnjak, posted with one other before the office of Aleksander Kardelj, winced when he saw the Party head approaching. He muttered from the side of his mouth, "Watch out. He's on a rampage. In this mood, he'd as well set you to filling salt shakers in the Nairebis mines as . . ."

But Zoran Jankez was now near enough that he might hear, and Veljko Gosnjak cut himself off abruptly and came to even stiffer attention.

Number One ignored them both and pushed on through the door.

Even as his right-hand man looked up from his work, Jankez was growling ominously. "Do you know the latest from that brain-wave experiment?"

Kardelj was close enough to the other personally to at least pretend lack of awe. He grinned and said, "You mean young Josip? Sit down, Zoran. A drink?"

The Number Two Party man swiveled slightly and punched out a code on a series of buttons. Almost immediately, an area of approximately one square foot sank down from the upper right-hand corner of his desk, to rise again bearing two chilled glasses.

Jankez snorted his anger but took up one of the glasses. "These everlasting gadgets from the West," he growled. "One of these days, this confounded desk of yours will give you an electric shock that will set me to looking for a new assistant." He threw the contents of the glass back over his palate. "If I don't start looking before that time," he added ominously.

However, he savored the drink, then put down the glass, pursed his lips and rumbled, "Where do you get this excellent slivovka, Aleksander?"

Kardelj sipped part of his own drink. He said lightly. "That is the only secret I keep from you, Zoran. However, I will give you this hint. Its proper name is slji-

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vovica, rather than slivovka. It does not come from Slovenia. I am afraid, once you know its origin, I will no longer be of use to you."

He laughed again. "But what is it that young Josip has done?"

His superior's face resumed its dark expression. He growled, "You know Velimir Crvenkovski, of course."

Kardelj raised scanty eyebrows. "Of course, Vice chairman of the Secretariat of Agriculture."

Zoran Jankez had lowered his clumsy bulk into a chair. Now he said heavily, his voice dangerous. "Velimir and I were partisans together. It was I who converted him to the Party, introduced him to the works of Lenin while we squatted in foxholes in Macenegro."

"Of course," the other repeated. "I know the story very well. A good Party man, Comrade Crvenkovski, never failing to vote with you in meetings of the Executive Committee."

"Yes," Jankez growled ominously. "And your precious Josip Pekic, your expediter, has removed him from his position as supreme presider of agriculture in Bosnatia."

Aleksander Kardelj cleared his throat. "I have just been reading the account. It would seem that production has fallen off considerably in the past five years in Bosnatia. Ah, Comrade Crvenkovski evidently had brought to his attention that wild life in the countryside, particularly birds, accounted for the loss of hundreds of thousands of tons of cereals and other produce annually."

"A well-known fact," Jankez rasped. He finished what remained of his drink, and reached forward to punch out the order for a fresh one. "What has that got to do with this pipsqueak using the confounded powers you invested him with to dismiss one of the best Party men in Transylvania?"

His right-hand man had not failed to note that he was now being given full credit for the expediter idea. He said, still cheerfully, however, "It would seem that Comrade Crvenkovski issued top priority orders to kill off, by whatever means possible, all birds. Shotguns, poison, nets were issued by the tens of thousands to the peasants."

"*Well?*" his superior said ominously. "Obviously, Velimir was clear minded enough to see the saving in gross production."

"Um-m-m," Kardelj said placatingly. "However, he failed to respond to the warnings of our agriculturists who have studied widely in the West. It seems as though the balance of nature calls for the presence of wildlife, and particularly birds. The increase in destructive insects has more than counterbalanced the amount of cereals the birds once consumed. Ah, Zoran," he said with a wry smile, "I would suggest we find another position for Comrade Crvenkovski."

The secretary-receptionist looked up at long last at the very average looking young man before him. "Yes," he said impatiently.

The stranger said, "I would like to see Comrade Broz."

"Surely you must realize that the Commissar is one of the busiest men in Transbalkania, Comrade." There was mocking sneer in the tone. "His time is not at the disposal of every citizen."

The newcomer looked at the petty authority thoughtfully. "Do you so address everyone that enters this office?" he asked mildly.

The other stared at him, flabbergasted. He suddenly banged upon a button on the desk.

When the security guard responded to the summons, he gestured curtly with his head at the newcomer. "Throw this fool out, Petar," he rapped.

Josip Pekic shook his head, almost sadly. "No," he said. "Throw *this* man out." He pointed at the secretary-receptionist.

The guard called Petar blinked at each of them in turn.

Josip brought forth his wallet, fidgeted a moment with the contents, then flashed his credentials. "State expediter," he said nervously. "Under direct authority of Comrade Zoran Jankez." He looked at the suddenly terrified receptionist. "I don't know what alternative work we can find to fit your talents. However, if I ever again hear of you holding down a position in which you meet the public, I will . . . will, ah, see you imprisoned."

The other scurried from the room before Josip thought of more to say.

Josip Pekic looked at the guard for a long moment. He said finally, unhappy still, "What are you needed for around here?"

"Why yes, Comrade. I am the security guard."

Petar, obviously no brain at the best, was taken aback.

"You didn't answer my question." Josip's hands were jittering so he jammed them into his pockets.

Petar had to think back to remember the wording of the question in question. Finally he came up triumphantly with, "Yes, Comrade. I guard Comrade Broz and the others from assassins. I am armed." He proudly displayed the Mikoyan Noiseless which he had holstered under his left shoulder.

Josip said, "Go back to your superior and inform him that I say you are superfluous on this assignment. No longer are commissars automaticallly to be guarded. Only under special circumstances. If . . . well, if our people dislike individual commissars sufficiently to wish to assassinate them, maybe they need assassination."

Petar stared at him.

"Oh, get out," Josip said, with attempted sharpness. But then, "What door leads to Comrade Broz's office?"

Petar pointed, then got out. At least he knew how to obey orders, Josip decided. What was there about the police mentality? Were they like that before they be-

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came police, and the job sought them out? Or did the job make them all that way?

He pushed his way through the indicated door. The office beyond held but one inhabitant who stood, hands clasped behind his back, while he stared in obvious satisfaction at a wall of charts, maps and graphs.

The average young man looked at some of the lettering on the charts and shook his head. He said, his voice hesitant, "Commissar Broz?"

The other turned, frowning, not recognizing his caller and surprised to find him here without announcement. He said, "Yes, young man?"

Josip presented his credentials again.

Broz had heard of him. He hurried forth a chair, became expansive in manner. A cigar? A drink? A great pleasure to meet the Comrade Expediter. He had heard a great deal about the new experiment initiated by Comrade Jankez and ably assisted by Aleksander Kardelj. Happily, an expediter was not needed in the Transbalkian Steel Complex. It was expanding in such wise as to be the astonishment of the world, both East and West.

"Yes," Josip began glumly, "but—"

Broz was back on his feet and to his wall of charts and graphs. "See here," he beamed expansively. "This curve is steel production. See how it zooms? A veritable Sputnik, eh? Our statistics show that we are rapidly surpassing even the most foremost of the Western powers."

Josip Pekic said, almost apologetically in view of the other's enthusiasm. "That's what I came to discuss with you, Comrade. You see, I've been sitting around, ah, in the local wineshops, talking it over with the younger engineers and the men on the job."

The other frowned at him. "Talking what over?"

"This new policy of yours." Josip's voice was diffident.

"You mean overtaking the steel production of the West, by utilizing *all* methods of production?" The commissar's voice dropped. "I warn you Comrade, the germ of this idea originated with Zoran Jankez himself. We are old comrades and friends from back before the revolution."

"I'm sure you are," Josip said pessimistically, and suppressing an urge to bite at the skin of his thumb. "However . . . well, I'm not so sure Number One will admit your program originated with him. At least, it hasn't worked out that way in the recent past when something soured."

The other bug-eyed. He whispered, "That approaches cynical treason, Comrade."

Josip half nodded, said discouragedly, "You forget. By Comrade Jankez's own orders I . . . I can do no wrong. But so much for that. Now, well, this steel program. I'm afraid it's going to have to be scrapped."

"Scrapped!" the Commissar of the Transbalkanian Steel Complex stared at his visitor as though the other was rabid. "You fool! Our steel progress is the astonishment of the world! Why, not only are our ultramodern plants, built largely with foreign assistance, working on a twenty-four hour a day basis, but thousands of secondary smelters, some so small as to be operated by a handful of comrade citizens, in backyard establishments, by schoolchildren, working smelters of but a few tons monthly capacity in the schoolyard, by—"

The newly created State Expediter held up a hand dispiritedly. "I know. I know. Thousands of these backyard smelters exist . . . uh . . . especially in parts of the country where there is neither ore nor fuel available."

The commissar looked at him.

The younger man said, his voice seemingly deprecating his words, "The schoolchildren, taking time off from their studies, of course, bring scrap iron to be smelted. And they bring whatever fuel they can find, often pilfered from railway yards. And the more scrap and fuel they bring, the more praise they get. Unfortunately, the so-called scrap often turns out to be kitchen utensils, farm tools, even, on at least one occasion, some railroad tracks, from a narrow gauge line running up to a lumbering project, not in use that time of the year. Sooner or later, Comrade Broz, the nation is going to have to replace those kitchen utensils and farm tools and all the rest of the scrap that isn't really quite scrap."

The commissar began to protest heatedly, but Josip Pekic shook his head and tried to firm his less than dominating voice. "But even that's not the worst of it. Taking citizens away from their real occupations, or studies, and putting them to smelting steel where no ore exists. The worst of it is, so my young engineer friends tell me, that while the steel thus produced might have been a marvel back in the days of the Hittites, it hardly reaches specifications today. Perhaps it might be used ultimately to make simple farm tools such as hoes and rakes; if so, it would make quite an endless circle, because that is largely the source of the so-called steel to begin with—tools, utensils and such. But it hardly seems usable in modern industry."

The commissar had gone pale with anger by now. He put his two fists on his desk and leaned upon them, staring down at his seated visitor. "Comrade," he bit out, "I warn you. Comrade Jankez is enthusiastic about my successes. Beyond that, not only is he an old comrade, but my brother-in-law as well."

Josip Pekic nodded, unenthusiastically, and his voice continued to quiver. "So the trained engineers under you, have already warned me. However, Comrade Broz, you are . . . well, no longer Commissar of the Steel Complex. My report has already gone in to Comrades Jankez and Kardelj."

The knock came at the door in the middle of the night, as Aleksander Kardelj had always thought it would.

From those early days of his Party career, when his

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ambitions had sent him climbing, pushing, tripping up others, on his way to the top, he had expected it eventually.

Oh, his had been a different approach, on the surface, an easygoing, laughing, gentler approach than one usually connected with members of the Secretariat of the Executive Commitee of the Party, but it made very little difference in the very long view. When one fell from the heights, he fell just as hard, whether or not he was noted for his sympathetic easy humor.

The fact was, Aleksander Kardelj was not asleep when the fist pounded at his door shortly after midnight. He had but recently turned off, with a shaking hand, the Telly-Phone, after a less than pleasant conversation with President of the United Balkan Soviet Republics, Zoran Jankez.

For the past ten years, Kardelj had been able to placate Zoran Jankez, even though Number One be at the peak of one of his surly rages, rages which seemed to be coming with increasing frequency of late. As the socio-economic system of the People's Democratic Dictatorship became increasingly complicated, as industrialization with its modern automation mushroomed in a geometric progression, the comparative simplicity of governing which applied in the past, was strictly of yesteryear. It had been one thing, rifle and grenades in hand, to seize the government, after a devastating war in which the nation had been leveled, and even to maintain it for a time, over illiterate peasants and unskilled proletarians. But industrialization calls for a highly educated element of scientists and technicians, nor does it stop there. One of sub-mentality can operate a shovel in a field, or even do a simple operation on an endless assembly line in a factory. But practically all workers must be highly skilled workers in the age of automation, and there is little room for the illiterate. The populace of the People's Dictatorship was no longer a dumb, driven herd, and their problems were no longer simple ones.

Yes, Number One was increasingly subject to his rages these days. It was Aleksander Kardelj's deepest belief that Jankez was finding himself out of his depth. He no longer was capable of understandng the problems which his planning bodies brought to his attention. And he who is confused, be he ditchdigger or dictator, is a man emotionally upset.

Zoran Jankez's face had come onto the Telly-Phone screen already enraged. He had snapped to his right-hand man, "Kardelj! Do you realize what that . . . that idiot of yours has been up to now?"

Inwardly, Kardelj had winced. His superior had been mountingly difficult of late, and particularly these past few days. He said now, cajolingly, "Zoran, I—"

"Don't call me Zoran, Kardelj! And please preserve me from your sickening attempts to fawn, in view of your treacherous recommendations of recent months." He was so infuriated that his heavy jowls shook.

Kardelj had never seen him this furious. He said placatingly, "Comrade Jankez, I had already come to the conclusion that I should consult you on the desirability of revoking this young troublemaker's credentials and removing him from the—"

"I am not interested in what you were *going* to do, Kardelj. I am already in the process of ending this traitor's activities. I should have known, when you revealed he was the son of Ljubo Pekic, that he was an enemy of the State, deep within. I know the Pekic blood. It was I who put Ljubo to the question. Stubborn, wrong headed, a vicious foe of the revolution. And his son takes after him."

Kardelj had enough courage left to say, "Comrade, it would seem to me that young Pekic is a tanglefoot, but not a conscious traitor. I—"

"Don't call me comrade, Kardelj!" Number One roared. "I know your inner motivation. The reason you brought this agent provocateur, this Trotskite wrecker, to his position of ridiculous power. The two of you are in conspiracy to undermine my authority. This will be brought before the Secretariat of the Executive Committee, Kardelj. You've gone too far, this time!"

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Aleksander Kardelj had his shortcomings but he was no coward. He said, wryly, "Very well, sir. But would you tell me what Josip Pekic has done now? My office has had no report on him for some time."

"What he has done! You fool, you traitorous fool, have you kept no record at all? He has been in the Macedonian area where my virgin lands program has been in full swing."

Kardelj cleared his throat at this point.

Jankez continued roaring. "The past three years, admittedly, the weather has been such, the confounded rains failing to arrive on schedule, that we have had our troubles. But this fool! This blundering traitorous idiot!"

"What has he done?" Kardelj asked, intrigued in spite of his position of danger.

"For all practical purposes he's ordered the whole program reversed. Something about a sandbowl developing, whatever that is supposed to mean. Something about introducing contour plowing, whatever nonsense that is. And even reforestating some areas. Some nonsense about watersheds. He evidently has blinded and misled the very men I had in charge. They are supporting him, openly."

Jankez, Kardelj knew, had been a miner as a youth, with no experience whatsoever on the soil. However, the virgin lands project had been his pet. He envisioned hundreds upon thousands of square miles of maize, corn as the Americans called it. This in turn would feed vast herds of cattle and swine so that ultimately the United Balkan Soviet Republics would have the highest meat consumption in the world.

Number One was raging on. Something about a conspiracy on the part of those who surrounded him. A conspiracy to overthrow him, Zoran Jankez, and betray the revolution to the Western powers, but he, Zoran Jankez, had been through this sort of plot before. He, Zoran Jankez, knew the answers to such situations.

Aleksander Kardelj grinned humorously, wryly, and reached to flick off the screen. He twisted a cigarette into the small pipelike holder, lit it and waited for the inevitable.

It was shortly after that the knock came on his door.

Zoran Jankez sat at his desk in the Ministry of Internal Affairs, a heavy military revolver close to his right hand, a half empty liter of sljivovica and a water tumbler, to his left. Red of eye, he pored over endless reports from his agents, occasionally taking time out to growl a command into his desk mike. Tired he was, from the long sleepless hours he was putting in, but Number One was in his element. As he had told that incompetent, Kardelj, he had been through this thing before. It was no mistake that he was Number One.

After a time he put a beefy hand down on the reports. He could feel the rage coming upon him. Of late, he realized, there most certainly had developed a plot to undermine his health by constant frustrations. Was there no one, no one at all, to take some of these trivialities off his shoulders? Must he do everything in the People's Democratic Dictatorship? Make every decision and see it through?

He snapped into the mike, "Give me Lazar Jovanovic." And then, when the police head's shaven poll appeared in the screen of the Telly-Phone. "Comrade, I am giving you one last chance. Produce this traitor, Josip Pekic, within the next twenty-four hours, or answer to me." He glared at the other, whose face had tightened in fear. "I begin to doubt the sincerity of your efforts, in this, Comrade Jovanovic."

"But . . . but, Comrade, I—"

"That's all!" Number One snapped. He flicked off the instrument, then glowered at it for a full minute. If Jovanovic couldn't locate Pekic, he'd find someone who could. It was maddening that the pipsqueak had seemingly disappeared. To this point, seeking him had progressed in secret. There had been too much favorable publicity churned out in the early days of the expediter scheme to reverse matters to the point of having a public hue and cry. It was being done on the q.t.

But! Number One raged inwardly, if his police couldn't find the criminal soon enough, a full-scale hunt and purge could well enough be launched. There was more to all this than met the eye. Oh, he, Zoran Jankez had been through it before, though long years had lapsed since it had been necessary. The traitors, the secret conspiracies, and then the required purges to clean the Party ranks still once again.

The gentle summons of his Telly-Phone tinkled, and he flicked it on with a rough brush of his hand.

And there was the youthful face of Josip Pekic, currently being sought high and low by the full strength of the Internal Affairs Secretariat. Youthful, yes, but even as he stared his astonishment, Zoran Jankez could see that the past months had wrought their changes on the other's face. It was more mature, bore more of strain and weariness.

Before Jankez found his voice, Josip Pekic said diffidently, "I . . . I understand you've been, well . . . looking for me, sir."

"Looking for you!" the Party head bleated, his rage ebbing in all but uncontrollably. For a moment he couldn't find words.

Pekic said, his voice jittering, "I had some research to do. You see, sir, this . . . this project you and Kardelj started me off on—"

"I had nothing to do with it! It was Kardelj's scheme, confound his idiocy!" Number One all but screamed.

"Oh? Well . . . well, I had gathered the opinion that both of you concurred. Anyway, like I say, the project from the first didn't come off quite the way it started. I . . . well . . . we, were thinking in terms of finding out why waiters were surly, why workers and professionals and even officials all tried to, uh, beat the

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rap, pass the buck, look out for themselves and the devil take the hindmost, and all those Americanisms that Kardelj is always using."

Jankez simmered, but let the other go on. Undoubtedly, his police chief, Lazar Jovanovic was even now tracing the call, and this young traitor would soon be under wraps where he could do no more damage to the economy of the People's Democratic Dictatorship.

"But, well, I found it wasn't just a matter of waiters, and truckdrivers and such. It . . . well . . . ran all the way from top to bottom. So, I finally felt as though I was sort of butting my head against the wall. I thought I better start at . . . kind of . . . fundamentals, so I began researching the manner in which the governments of the West handled some of these matters."

"Ah," Jankez said as smoothly as he was able to get out. "Ah. And?" This fool was hanging himself.

The younger man frowned in unhappy puzzlement. "Frankly, I was surprised. I have, of course, read Western propaganda to the extent I could get hold of it in Zagurest, and listened to the Voice of the West on the wireless. I was also, obviously, familiar with our own propaganda. Frankly . . . well . . . I had reserved my opinion in both cases."

This in itself was treason, but Number One managed to get out, almost encouragingly, "What are you driving at, Josip Pekic?"

"I found in one Western country that the government was actually paying its peasants, that is, farmers, not to plant crops. The same government subsidized other crops, keeping the prices up to the point where they were hard put to compete on the international markets."

Young Pekic made a moue, as though in puzzlement. "In other countries, in South America for instance, where the standard of living is possibly the lowest in the West and they need funds desperately to develop themselves, the governments build up large armies, although few of them have had any sort of warfare at all for over a century and have no threat of war."

"What is all this about?" Number One growled. Surely, Lazar Jovanovic was on the idiot traitor's trail by now.

Josip took a deep breath and hurried on nervously. "They've got other contradictions that seem unbelievable. For instance, their steel industry will be running at half capacity, in spite of the fact that millions of their citizens have unfulfilled needs, involving steel. Things like cars, refrigerators, stoves. In fact, in their so-called recessions, they'll actually close down perfectly good, modern factories, and throw their people out of employment, at the very time that there are millions of people who need that factory's product."

Josip said reasonably, "Why, sir, I've come to the conclusion that the West has some of the same problems we have. And the main one is politicians."

"What? What do you mean?"

"Just that," Josip said with dogged glumness. "I . . . well, I don't know about the old days. A hundred, even fifty years ago, but as society becomes more complicated, more intricate, I simply don't think politicians are capable of directing it. The main problems are those of production and distribution of all the things our science and industry have learned to turn out. And politicians, all over the world, seem to foul it up."

Zoran Jankez growled ominously, "Are you suggesting that I am incompetent to direct the United Balkan Soviet Republics?"

"Yes, sir," Josip said brightly, as though the other had encouraged him. "That's what I mean. You or any other politician. Industry should be run by trained, competent technicians, scientists, industrialists—and to some extent, maybe, by the consumers, but not by politicians. By definition, politicians know about politics, not industry. But somehow, in the modern world, governments seem to be taking over the running of industry and even agriculture. They aren't doing such a good job, sir."

Jankez finally exploded. "Where are you calling from, Pekic?" he demanded. "You're under arrest!"

Josip Pekic cleared his throat, apologetically. "No, sir," he said. "Remember? I'm the average Transbalkanian citizen. And it is to be assumed I'd, well . . . react the way any other would. The difference is, I had the opportunity. I'm in Switzerland."

"Switzerland!" Number One roared. "You've defected. I knew you were a traitor, Pekic. Like father, like son! A true Transbalkanian would remain in his country and help it along the road to the future."

The younger man looked worried. "Well, yes, sir," he said. "I thought about that. But I think I've done about as much as I could accomplish. You see, these last few months, protected by those 'can do no wrong' credentials, I've been spreading this message around among all the engineers, technicians, professionals, all the more trained, competent people in Transbalkania. You'd be surprised how they took to it. I think it's kind of . . . well, snowballing. I mean the idea that politicians aren't capable of running industry. That if the United Balkan Soviet Republics are to ever get anywhere, some changes are going to have to be made."

Number One could no more than glare.

Josip Pekic, rubbed his nose nervously, and said, in the way of uneasy farewell, "I just thought it was only fair for me to call you and give a final report. After all, I didn't start all this. Didn't originate the situation. It was you and Kardelj who gave me my chance. I just . . . well . . . expedited things." His face faded from the screen, still apologetic of expression.

Zoran Jankez sat there for a long time, staring at the now dark instrument.

It was the middle of the night when the knock came at the door. But then, Zoran Jankez had always thought it would . . . finally. ■

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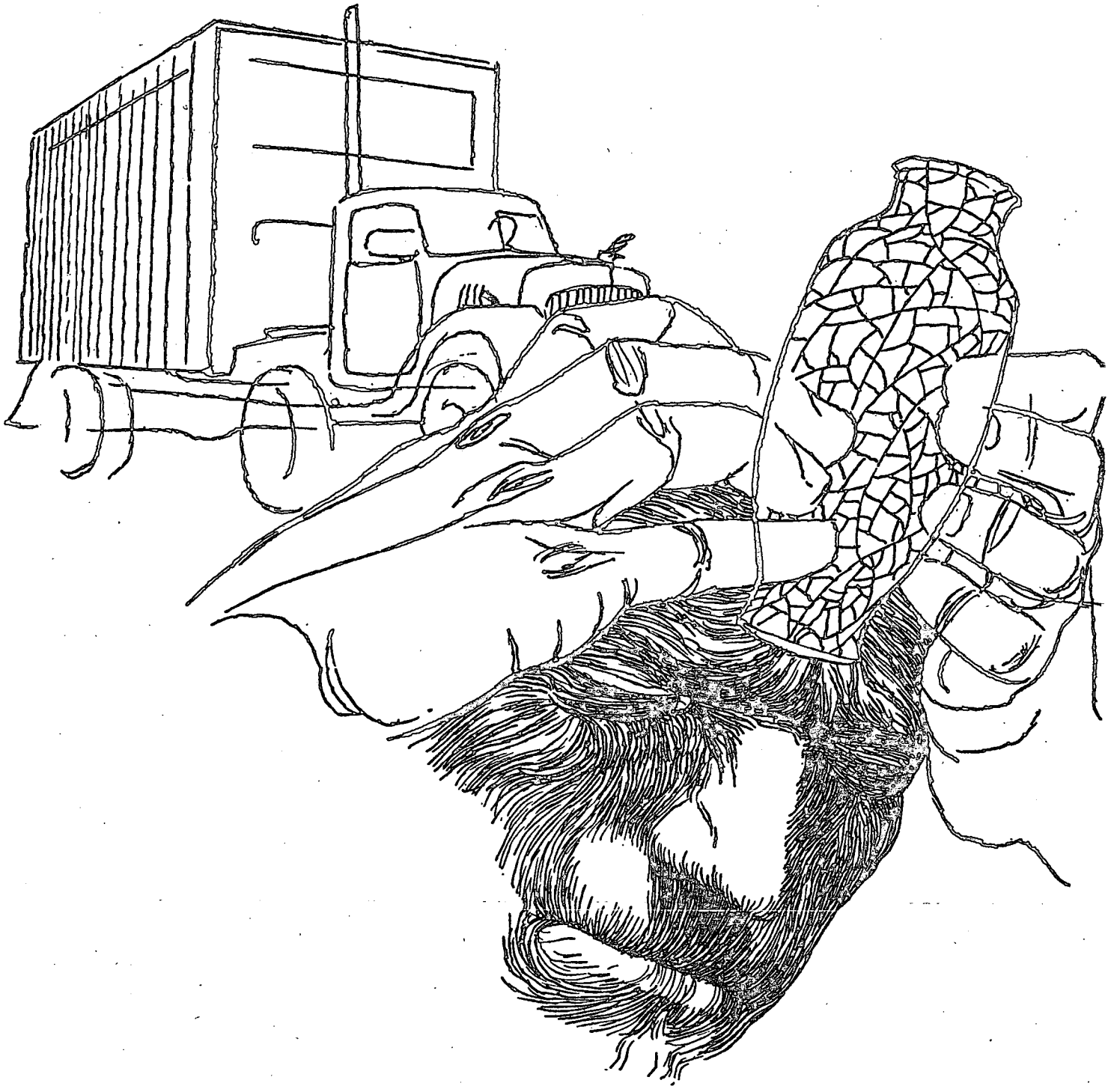

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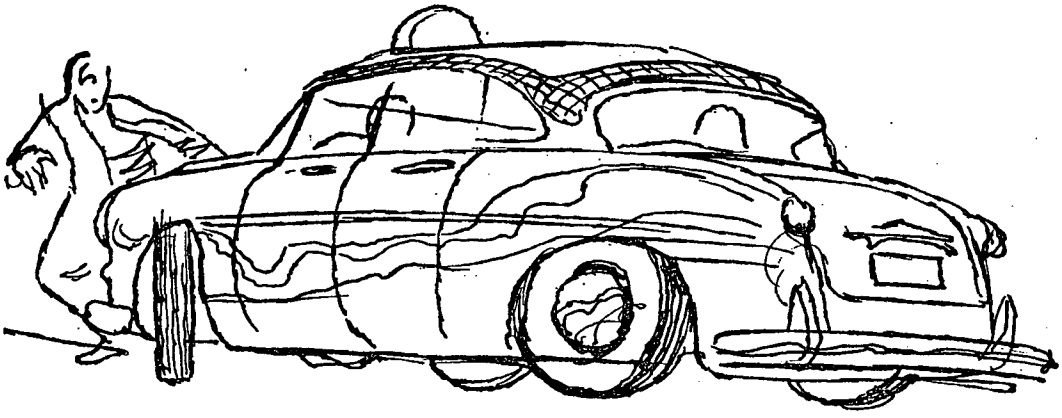
THE MING VASE

"You can't eat your cake and have it too," applies in a magnificently general way—but what is very readily overlooked is that the old saw implies a choice . . .

by E. C. Tubb

ILLUSTRATED BY JOHN SCHOENHERR



The antique shop was one of those high-class places which catered only to the very rich and the very possessive. A single vase of hand-worked glass stood in one window, an Egyptian Solar Boat in the other, between them the door presented a single expanse of unbroken glass to the street outside.

Don Gregson paused before it, deep-set eyes curious as they stared at the street. There was no trace of the accident. The wreckage had been removed and the rain had washed away the last traces of blood. Even the inevitable sightseers had gone about their business. Turning back to the door he pushed it open and stepped into the warmth inside.

Earlman was there, and Bronson, both standing beside a small, elderly man with delicate hands and intelligent eyes. Some assistants hovered discreetly in the background. The police had left and Don was glad of it. Earlman stepped forward.

"Hi, Don. You made good time."

"The general sees to that. Is that the owner?"

Max nodded, gesturing to the little man. Quickly he made the introductions.

"Mr. Levkin this is Don Gregson, C.I.A., Special Detachment."

They shook hands, Don surprised at the wirey strength in the delicate fingers. Bronson, as usual, merely stood and watched; a coiled spring waiting his moment of release.

"I wish we could have met under happier circumstances," said Don to the owner. "Please tell me all about it."

"Again?"

"If you please. First-hand reports are always the most reliable."

Levkin shrugged and spread his hands in a gesture almost as old as time.

"I have been robbed," he said with simple understatement. "I have been robbed of the most precious item in my shop. It was small, a vase from the Ming Dynasty, but it was beautiful. You understand?"

"How small?"

Levkin gestured with his hands and Don nodded.

"About six inches high, small enough to slip into a pocket. You said it was valuable. How valuable?"

"I said it was precious," corrected the owner. "How do you value a work of art? The price is what the purchaser is prepared to pay. Let me say only that I have refused one hundred thousand dollars for it."

Earlman grunted, his thin, harassed face and dark, bruised-looking eyes veiled behind the smoke of his cigarette.

"Tell us about the man."

"He was medium built, medium height, well-dressed, brown hair and eyes . . . remarkable eyes. About a hundred and seventy pounds, softly spoken, very gentle and polite."

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Over Levkin's head Earlman caught Don's eye and nodded.

"Nothing ostentatious," continued Levkin. "Nothing which gave a hint that he was not what he seemed. I had no reason to suspect that he was a thief."

"He isn't," said Don, then frowned at his own absurdity. "Go on."

"We spoke. He was interested in rare and beautiful things, it was natural that I should show him the vase. Then there was a crash in the street, an accident. Inevitably we turned and headed towards the door. It was a bad accident, our attention was distracted, but only for a moment. It was enough. By the time I remembered the man had gone and he had taken the vase with him."

"Are you positive as to that?" Don labored the point. "Could it be hidden here somewhere? Anywhere?"

"The police asked that. No, it is not hidden. I have made a thorough search. It has been stolen." For the first time the man showed emotion. "Please, you will get it back? You will do your best?"

Don nodded, jerking his head at Earlman as he stepped to one side. Bronson, as always, joined them.

"How about the identification?" Don spoke in a trained whisper inaudible two feet from his lips. "Is it positive?"

"They swear to the photograph. It's our man all right."

"I've got to be certain. How about the accident? Could that have been faked?"

"Not a chance. A cab hit a pedestrian and swerved into a truck. The jaywalker's dead, the cabbie will lose a leg and the truck driver's in a bad way. That was no rigged diversion."

"Coincidence?" Don shook his head. "No, the timing was too limited for that. Levkin's no fool and even the smartest crook requires a certain reaction time before he can spot an opportunity, weigh his chances and then swing into action. Levkin would never have given an ordinary crook that much time. It looks as if you're right, Max."

"I am right. It was Klieger." Earlman looked puzzled. "But why, Don? Why?"

Gregson didn't answer. His face was strained, thoughtful.

"Why?" repeated Earlman. "Why should he want to steal a thing he can't sell, can't eat, can't do anything with but sit and look at? Why?"

General Penn asked the same question but unlike Earlman he demanded an answer. Slumped in his chair behind the wide desk he looked even older and more harassed than he had when this whole thing had started. Don could understand that. The general, literally, had his neck on the block.

"Well?" The voice reflected the strain. Harsh, heavy with irritating undertones, it carried too much of the barrack square, too little of understanding or patience. "You've found what you said to look for. Now, what's the answer?"

"We've found something I said might possibly happen," corrected Don. "It has. What answer are you looking for?"

"Are you crazy!" Penn surged out of his chair. "You know what the top-priority is! Find Klieger! What other answer would I be interested in?"

"You might," said Don quietly, "be interested in finding out just why he left in the first place."

Penn said a word. He repeated it. Don tensed then forced himself to relax. Slowly he lit a cigarette.

"Three weeks ago," he said, "Albert Klieger decided to leave Cartwright House and did so. Since then you've had all field units concentrate on the one object of finding him. Why?"

"Because he is the greatest potential danger to this country walking on two legs!" Penn spat the words as if they were bullets. "If he gets to the other side and spills what he knows, we'll lose our greatest advantage in the cold war and the hot war when it comes. Gregson, you know all this!"

"I've been told it," said Don. He didn't look at the congested face of the general. "And if we find him and he doesn't want to return, what then?"

"We'll worry about then when we've found him," said Penn grimly. Don nodded.

"Is that why Bronson is always with my team? Why other men just like him accompany all field units?" He didn't press for an answer. "Have you ever wondered just why the English stopped using the Press Gang system? They knew it wasn't humane from the beginning but, for a while, it worked—for a while and up to a point. Maybe we could learn something from that if we tried."

"You talk like a fool." Penn slumped back into his chair. "No one press-ganged Klieger. I found him in a third-rate carnival and gave him the chance to help his country. He took that chance. It's fair to say that we've given him far more than he's given us. After all, Klieger isn't the only one."

"That," said Don, "is the whole point." He stared directly at the general. "How long is it going to be before others in the Project . . . sorry, Cartwright House, decide that they've had enough?"

"There'll be no more walking out." Penn was very positive. "I've tripled the security guards and installed gimmicks which makes that impossible."

It was, of course, a matter of locking the stable door after the horse had been stolen, but Don didn't point that out. Penn, with his reputation and career in the balance could only be pushed so far at a time. And, to Penn, his career was all-important. Not even Cartwright House came before that.

Which, thought Don bitterly, was the inevitable result of a military machine based on political maneuver-

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ings. What a man was, what he could do, that was unimportant against who he knew, what he could do for others. Don himself had no illusions. He was useful but he could be branded, damned, kicked out and made the scapegoat if Penn felt he needed a sacrifice. And time was running out.

"We've got to find him." Penn drummed on the desk. "Gregson, why can't you find him?"

"You know why. I've trailed him and found where he's been a dozen times. But always too late. To catch him I've got to be where he is when he is, or before he gets there. And that's impossible."

"This theft." Penn's mind veered to the latest scrap of information. "Money I can understand but why a Ming vase. The guy must be crazy."

"He isn't normal, but he isn't crazy." Don crushed out his cigarette. "And I've an idea that he has a very good reason for wanting that vase. The chances are that he will be collecting other, similar things, how many depends on circumstances."

"But why?"

"They're beautiful. To those that appreciate them such objects are beyond price. Klieger must have an intensely artistic streak. He has a reason for wanting to own them and it worries me."

Penn snorted.

"I need more information." Don was decisive. "Without it I'm fighting a shadow. I've got to go to where I can get it."

"But—"

"I've got to. There's no other way. None in the world."

No one called it a prison. No one even called it a Project because everyone knew that a "Project" was both military and important. So it was called Cartwright House and it was a little harder to get into than Fort Knox and far more difficult to leave than Alcatraz.

Don waited patiently as his identification was checked, double-checked, cleared to a higher level and then checked again. It took time but finally he faced, Leon Malchin, tall, thin, burning with frustrated zeal and with the courtesy rank of colonel which meant nothing until he tried to act like a civilian when he felt the full impact of military discipline.

"General Penn has contacted me," he said. "I am to offer you every assistance." He stared at Don through old-fashioned spectacles. "How can I help you?"

"Question," said Don. "How do normal men catch a clairvoyant?"

"You mean Klieger, of course?"

"Of course."

"They can't. They don't." Malchin settled back in his chair, a glint of amusement in his eyes. "Next question?"

"There is no next question—not yet." Don took the other chair and produced his cigarettes. Malchin shook his head and sucked at a briar.

"I am a hunter," he said abruptly. "I hunt men. I'm good at it because I have a knack, talent, skill—you name it—for being able to outguess my quarry. You might say that I have a series of lucky hunches. Somehow, I don't know how, I *know* what they will do next, where they will be and when. I have never failed to get my man yet."

"But you haven't got Klieger." Malchin nodded as if he had expected this visit for some time. "And you want to know why."

"I know why. He is a clairvoyant. What I want to know is how. How does he do it? How does he operate? How effective is he?"

"Very effective." Malchin took his pipe from his mouth and stared into the bowl. "He is, was, our star resident. He could see further than anyone I have ever investigated—and I have investigated psi phenomena all my adult life."

"Go on."

"I don't think you fully realize just what you are up against in Klieger. He is a superman, of course; nothing like that, but he has this one talent. You are, in a sense, a blind man trying to trap a man who can see. Trap him in broad daylight on an open plain. You are also wearing a bell around your neck to attract his attention. Personally I do not think you have a ghost of a chance."

"How," Don insisted, "does this talent work?"

"I don't know." Malchin anticipated the next question. "You don't mean that, of course, what you mean is how does he use it. If I knew how it worked, I would be a very happy man." He frowned, searching for words. "This is going to be difficult to describe. How could you explain sight to a man born blind, or sound to a man born deaf? And you, at least, could tell how those senses 'worked.' However—"

Don lit another cigarette, listening to Malchin's explanations, building pictures in his mind. A piece of rough fabric each thread of which was a person's life stretching into the future. Some threads were short, others longer, all meshed and interwoven so that it was almost impossible to follow any single thread. But, with training and skill it could be done. Then events came clear and action could be planned.

A bank where a teller suffered an attack of acute appendicitis just as he was counting out a sheaf of notes —and a man who calmly picked them up as if he had just cashed a check.

A store where the taking were left unattended for just that essential few minutes of time.

A penthouse apartment and an officer who sneezed just as the quarry walked past.

An antique shop and an accident to create the necessary diversion.

So simple when you could see exactly what would happen and exactly how to take advantage of it.

How to catch Klieger?

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Don jerked upright as his cigarette burned his fingers and became aware of Malchin's stare.

"I was thinking of your analogy," he said. "You know, the blind man trying to trap the one who could see. I know how it can be done."

"Yes?"

"The blind man gets eyes."

They were comfortable. They had soft beds and good food, canned music, television, a library of books and private movies. They had games and a swimming pool and even a bowling alley. They wore good clothes and were fit and looked it, but they were intelligent and they knew.

A prison is somewhere you can't leave when you want to and they were in a prison.

For their own protection, naturally. The guards, the gimmicks, the restrictions were solely designed to keep unwanted people out. The secrecy was from fear of spies and patriotism was the excuse for all. But the things designed to keep people out worked just as well to keep others in.

And, sometimes, patriotism as an excuse wears a little thin.

"It's good to see a new face." Sam Edwards, fifty, built like a boy with the face of a boxer, grinned as he gripped Don's hand. "You joining the club?"

"He's just visiting." A wizened oldster sucked at his teeth as he peered at Don from the depths of an easy-chair. "Say, Gregson, if you'd fancy a little poker later on I guess we could accommodate you."

He laughed with a wheezy effort then frowned and slammed a thin hand on his knee.

"Goldarn it! I miss my poker!"

"Telepaths," whispered Malchin. "Most of them are in permanent rapport with others who are you-know-where. I won't bother to introduce you around."

Don nodded, staring uneasily at the assembled "residents." Some were old, a few young, most were middle-aged. They watched him with eyes glinting with secret amusement.

"Oddly enough most of them seem to stick together according to their various talents," mused Malchin. "You've seen the telepaths, in this room are those with telekinetic abilities. Nothing startling in the way of progress as yet but they are getting on. In here are the clairvoyants."

There were fifteen of them, Don was surprised at the number, then he wondered why he was surprised. In the great cross-section of humanity which was the United States every deviation from the norm must have been repeated many times. Shrewdly he guessed that he saw only a part of the whole; that Cartwright House was duplicated many times under many names.

"We have found," whispered Malchin, "that communal use of their talent greatly aids development of that talent. Klieger was little more than a carnival fortune teller when he joined us; in ten years he became amazingly proficient."

"Ten years?"

"That's what I said. Many of our residents have been here longer than that."

If there was irony in Malchin's voice Don didn't catch it. But one of the men in the room did. He came forward, hand outstretched, a taut smile on his face.

"Tab Wellker," he said. "Maybe you can settle an argument. In England, from what I hear, a man sentenced to life imprisonment usually gets out in about nine years. Right?"

"It depends on his conduct." Don felt his skin tighten as he saw what the man was driving at. "A life term in England is about fifteen years. A third remission would make it about what you say."

"And that's usually given for nothing short of murder." Tab nodded. "You know, I've been here eight years. One more year to go—maybe!"

"You're not a prisoner," said Don. The man laughed.

"Please." He lifted his hand. "No arguments, no speeches!" He lost his smile. "What do you want?"

"Help," said Don simply.

He moved about the room, halting by a small table bearing chessmen set out on a board. They were of wood lovingly carved with the unfinished look of true hand-production. He lifted a knight and studied it, then met Wellker's eyes.

"Klieger's?"

"How did you guess?" Tab's eyes softened as he stared at the men. "Albert loved beautiful things. The thing he missed most while he was here was being able to visit the museums. He always said that man's true achievements were to be found in the things he had made to ornament his life."

"Things like vases?"

"Paintings, statuary, cameos, he liked them all providing they were well made."

"A man with artistic appreciation." Don nodded. "I understand. When did you all decide to help him escape?"

"I . . . What did you say?"

"You heard what I said." Don's eyes locked with those of the other man then, slowly, Wellker smiled.

"You're no fool," he said. Don returned the smile.

"Now I've another question." He paused, conscious of their eyes. "Just what does Klieger hope to gain?"

"No!" General Penn slammed his hand down on the arm of the back seat. "No! No!"

Don sighed, staring through the windows at the rain. It dripped from the trees above, pinging on the roof of the car, dewing the glass with a glitter of transient pearls. Further down the road the rear of another car loomed vague through the rain. Behind them would be another. Their own driver was somewhere up ahead probably cursing the odd exigencies of the Service.

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"Listen," said the general, "we've got word that they know about Klieger. Don't ask me how they even guessed he was important to us, but they do. Now it's a race between us. We daren't lose."

"We won't lose," said Don. "But we'll have to do it my way. It's the only way there is."

"No!"

"General!" Don released his pent up temper and frustration in a furious blast of sound. "What other way is there?"

It stopped Penn as he knew it would but only for a moment.

"I can't risk it," he snapped. "Klieger's only one man, dangerous but still only one. We can handle one man but can we handle a dozen or more? It's treasonable even to suggest it."

Don fumed as he recognized the emotion-loaded semantic symbol. Penn with his mania for security had probably aroused unwelcome attention in the first place. Like now when he had insisted that they meet in a car on a road in the rain for fear of some undetected electronic ear waiting to catch their conversation.

For long moments the silence dragged, then Don drew a deep breath.

"Treasonable or not it's something you have to consider. For one thing the escape was organized. The lights failed—a telepathically controlled rat gnawed a vital cable. A guard was taken sick for no apparent reason and for a moment there was a blank spot in the defenses. There were other things, all small, not one coincidental. The whole lot could have walked right out."

"But they didn't!" Penn pounded the arm of the rear seat. "Only Klieger. That proves something."

"That he wanted to run to the Reds?" Don shrugged. "Then what's keeping him? He's had plenty of time to make contact if that's what he wanted."

"What's your point?" Penn was losing his patience. "Are you trying to tell me that those . . . freaks back there are holding a gun to my head? They'll help, you say, but on their terms. Terms!" His hand closed into a fist. "Don't they understand that the country is as good as at war?"

"They want the thing we keep saying we are fighting to protect," said Don. "They want a little freedom. Is that such an outrageous demand?"

He leaned back, closing his eyes, seeing again the faces of the men back in Cartwright House. Some of them, so Malchin had said, had been there twelve years. A long time. Too long to be willing guinea pigs so that their talents could be trained and developed and exploited. But to the general they weren't men. They were "freaks"; just another weapon to be used, to be protected and hidden, to be destroyed if there was a chance they might fall into enemy hands.

"What?" He opened his eyes, conscious that the general was talking to him. Penn glowered and repeated what he had said.

"Can you catch him, even if they won't help you?"

"I don't know." Don pursed his lips, shadowed eyes introspective beneath prominent brows. "I feel that we've gone about this thing in the wrong way. We've thought of it as just another man-hunt and we've failed because we're trying to catch no ordinary man. There must be a purpose behind what Klieger did. Find the reason for his leaving and we'll find the purpose."

"Isn't that what you went to find out?" Penn made no effort to hide his sarcasm.

"Yes. I didn't fail."

"Then—?"

"He stole a rare vase of the Ming Dynasty," said Don. "Find out why and you have the answer."

Max Earlman lay supine on the bed and stared at the ceiling. The small hotel room was warm, littered with the personal effects of the three men. Against one wall a large-scale map of the city hung slightly out of true, the grid-pattern of streets marked with a host of colored pins. Beyond the windows the early evening had softened the harsh outlines of the concrete jungle, turning even the garish illuminations into things of glowing beauty.

Bronson stirred where he sat at a table, the thin reek of gun oil harsh to Earlman's nostrils. He lit a cigarette to kill the odor and stared distastefully at the other man.

"Do you have to do that?" Smoke plumed from the cigarette as Max gestured towards the pistol Bronson was cleaning. Bronson continued with his business.

"What gives with you, Bronson?" Earlman swung to his feet, nerves taut with irritation. "You walk and eat and sleep and I guess you can talk, too, if you set your mind to it, but are you really a man?"

Metal clicked with deadly precision as Bronson reassembled the gun. He tucked it into its holster, drew it with a fantastic turn of speed, returned it again.

Earlman jerked to his feet, anger burning in the deep, bruised-looking eyes. He turned as Don entered the room. He looked tired.

"No luck?" Max knew the answer. Don shook his head.

"We're still on our own." Crossing the room he stood before the map, studying the clusters of colored pins. "Have you got them all?"

"Every single one." Earlman blew smoke at the map. "If anyone ever tells me this city has no culture, I'll tear them apart. The place is lousy with art galleries, museums, exhibitions, antique shops, displays, missions and what have you. I've marked them all." He looked sidewise at Gregson's bleak face. "There are a lot, Don. Too many."

"We can whittle them down." Don sighed, feeling the tension of the past few weeks building up inside, the tautness of the past few days stretching his nerves. He forced himself to relax, taking deep breaths, forgetting the urgency and Penn's hysterical demands.

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"Cut out foreign films, contemporary art, modernistic paintings, exhibitions of abstract design. Eliminate the stamp collections, trade missions, engineering displays. Concentrate on the old, the rare, the beautiful."

"How close should I go?"

"Close. Keep the unusual, the short-term, the items loaned from private collections."

Earlman nodded and busied himself with colored pins and a sheaf of catalogues. Don turned and stared out of the window.

Below him the city sprawled, scarlike streets slashing between soaring anthills of concrete, the whole glittering with light. Somewhere in the city another man probably stood staring from a window—a mild man with a love of artistic things. A man who, until recently, had lived a law-abiding existence and who, suddenly, had broken the conditioning of a lifetime to rob and steal and run.

Why?

Frustration, yes, all the "residents" of Cartwright House were frustrated but they had remained when they could have left. Only Klieger had run and had kept running. Now he was somewhere in the city, his talent warning him of approaching danger, showing him how to dodge and move and avoid so as to remain free.

Free in order to do what?

Don sighed, wondering for the thousandth time just how it must feel to be clairvoyant. He could visualize the future—or could he? The others could have helped but Penn had blocked that. With a dozen other clairvoyants Don could have covered the field and trapped Klieger by sheer weight of numbers. No one man, no matter how gifted, could have beaten such odds.

Now he was on his own.

It had begun to rain and the window glittered with reflected light so that his eyes constantly changed focus from the window to the city beyond then back to the window. Then he stopped trying to focus and just stood, eyes wide, thoughts traveling unfamiliar paths.

How?

How did he know when and where to catch a wanted man? What was it that made him just that little different from other men? All his life Don had had that edge. He could guess—if it was guessing—and those guesses had been right. So, was it guessing? Or did he know?

His record had backed his application to the C.I.A. That same record of unbroken success had paved his way into the Special Detachment. He was a man-hunter who always found his man. And he didn't know how he did it.

As Malchin didn't know how the "residents" at Cartwright House used their talents.

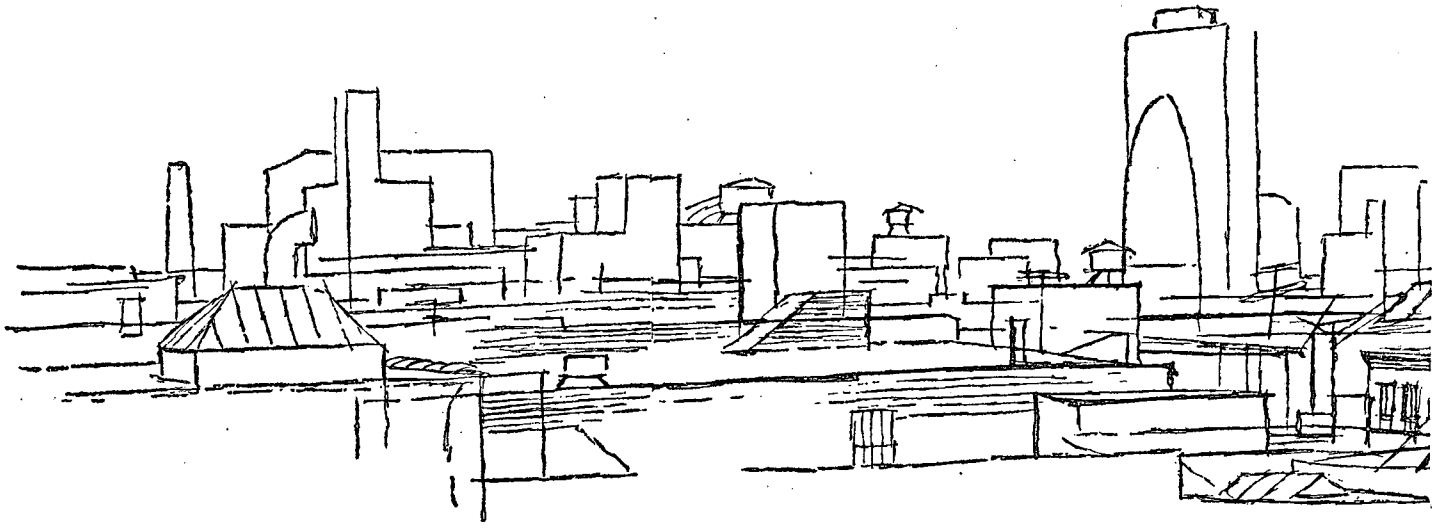
Even whittled down the list was too long. Earlman gestured towards the map, smoke drifting from the cigarette dangling from his lips, pointing to the varicolored pins.

"I can't get it closer than this, Don. From here on it's pure guesswork."

"Not quite." Don scanned the list. "I learned something about Klieger back at Cartwright House. He is an artistic type. My guess is that he's been visiting the museums and art galleries all along."

"Then we've got him!" Earlman was jubilant. "All we need do is to cover these places and he'll walk right into our hands."

Don raised his eyebrows and Max suddenly sobered.



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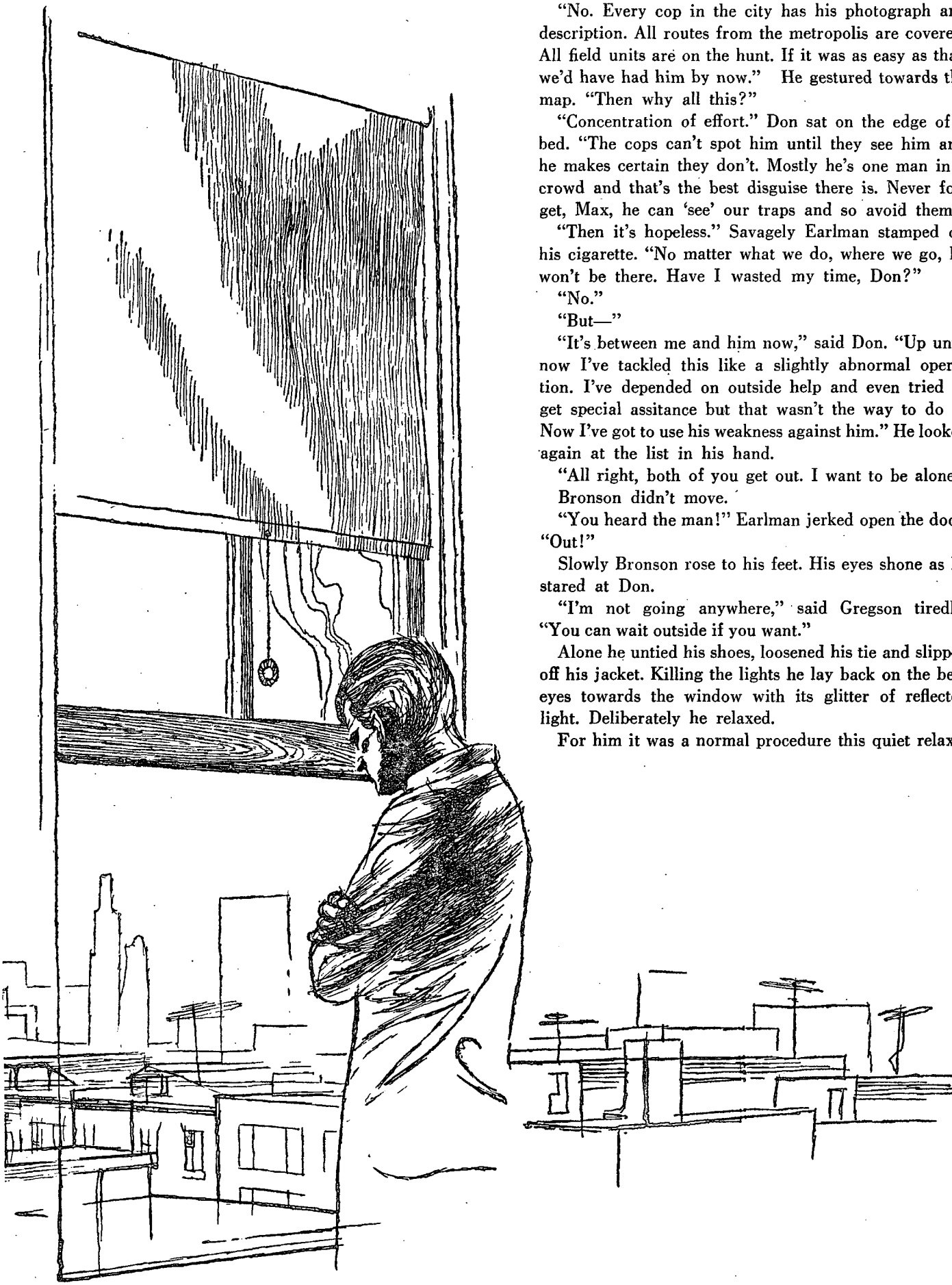

"No. Every cop in the city has his photograph and description. All routes from the metropolis are covered. All field units are on the hunt. If it was as easy as that, we'd have had him by now." He gestured towards the map. "Then why all this?"

"Concentration of effort." Don sat on the edge of a bed. "The cops can't spot him until they see him and he makes certain they don't. Mostly he's one man in a crowd and that's the best disguise there is. Never forget, Max, he can 'see' our traps and so avoid them."

"Then it's hopeless." Savagely Earlman stamped on his cigarette. "No matter what we do, where we go, he won't be there. Have I wasted my time, Don?"

"No."

"But—"

"It's between me and him now," said Don. "Up until now I've tackled this like a slightly abnormal operation. I've depended on outside help and even tried to get special assitance but that wasn't the way to do it. Now I've got to use his weakness against him." He looked again at the list in his hand.

"All right, both of you get out. I want to be alone."

Bronson didn't move.

"You heard the man!" Earlman jerked open the door. "Out!"

Slowly Bronson rose to his feet. His eyes shone as he stared at Don.

"I'm not going anywhere," said Gregson tiredly. "You can wait outside if you want."

Alone he untied his shoes, loosened his tie and slipped off his jacket. Killing the lights he lay back on the bed, eyes towards the window with its glitter of reflected light. Deliberately he relaxed.

For him it was a normal procedure this quiet relaxa-

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tion while his mind digested the thousand odd items of assembled fact to come up with a guess that wasn't a guess because it was always right. But now he had to do more than that. Now he had to pit himself against a man who could "see" the future and he had to outguess that other man.

His breathing grew even, regular and deeper as he entered the first stage of self-hypnosis. Outside sounds wouldn't bother him now, there would be no distractions, he could concentrate fully on the problem he had to solve.

Find Klieger.

Find where he would be and when.

Find him as he had found a thousand others with no doubt, no uncertainty, just the conviction that at a certain place at a certain time he would spot his quarry.

Forget the sense that he was beaten before he could start. Forget that he was up against an abnormal talent. Forget the picture of the piece of fabric and the nodes of events. Forget everything but one man and where and when he would be.

"The Lustrum Galleries." Earlman nodded then grunted as the cab braked to avoid a jaywalker. "They are having a private showing this evening, invitation only. The exhibition doesn't open until tomorrow." He looked at Don, face even more haggard in the dim light. "Are you certain he will be there?"

"Yes."

"But—" Earlman shrugged and broke off, killing the obvious question. "A display of Chinese art," he read from a crumpled catalogue. "Ceramics from the Ming, Han and Manchu Dynasties. It figures. The Ming Vase?"

Don nodded, then closed his eyes, resting his head on the back of the seat. He felt drained, worn out yet filled with a glowing exultation. He *knew!* How or why he couldn't guess but he *knew!* Klieger would be at the galleries. He would stake his life on it.

Their badges got them in, past a very punctilious uniformed attendant, past a fussing curator, into a long hall shining with glass cases on which in reverent array stood the exhibits.

"Tomorrow," said the curator, "these will be within the cases but tonight, because of the selected visitors, we feel it safe to have them as they are."

"Why?" Earlman was blunt. "What's the point?"

"You are not a connoisseur," said the curator. "That is obvious. If you were, you would know that there is more to ceramics than just the visual aspect. There is a feel, a tactile sense which is as much a part of the pottery as the colors. Our visitors, most of them collectors, appreciate that. And, too, the true beauty of these pieces cannot be wholly appreciated when they are seen from only one angle as they will be when sealed in the cases."

He looked suddenly anxious.

"You haven't mentioned your business. I trust that nothing will—"

"There will be no trouble." Don glanced around the gallery, forehead creased in a frown. "Just operate as if we weren't here." He smiled at the anxious expression. "One thing I can promise you, your exhibits are in no danger."

Satisfied the curator bustled off about his business. Don glanced to either side then led the way towards the far end of the gallery.

"We'll wait here. The cases will screen us and we can watch the whole gallery. When Klieger comes you will go to the stairs, Max, and cut off his escape."

Earlman grunted then paused, a cigarette halfway to his lips.

"How come, Don? How come that Klieger is going to walk right into this setup when we know that he must know we're waiting for him?"

"He wants to see the exhibits."

"But—?"

"This is his only chance to actually touch and examine them. To him that's important, don't ask me why." Don's voice was sharp. "He'll be here, I know it."

It sounded logical. It sounded as if it could be true but Don knew that wasn't the reason Klieger would come. He would want to see the ceramics, that was true, but would he want to handle them so much that nothing else mattered? And, if so, why? Why tonight?

Waiting between the cases, eyes on the long vista of the gallery with its shining glass and neat exhibits Don fought the question which had puzzled him all along. In a way it was a seeming paradox but he knew that it only seemed that way to him. As the visitors began to arrive and the air vibrated to their murmured comments as they studied the exhibits the question nagged at his peace of mind.

Klieger must know he would be walking into a trap.

Yet he would come, Don was certain of it.

So, if Don wasn't mistaken and he was certain he was not, Klieger must consider the visit to be worth certain capture.

Capture or—

Bronson moved, an automatic gesture, one hand sliding beneath his coat and Don snarled at him with savage impatience.

"There'll be none of that! Do you understand? You won't be needed!"

Inwardly he cursed Penn's cold, inhuman logic. In war it is good sense to destroy material you can't use to prevent it falling into enemy hands, but this wasn't war and Penn wasn't dealing with machines or supplies.

Klieger must know the risk he ran of being shot to death.

Don started as Earlman gripped his arm. Max jerked his head, eyes bright in the haggard face as he stared down the gallery.

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"There, Don," he breathed. "Down by that big case. See him?"

Klieger!

He was—ordinary. Engrossed with the hunt Don had mentally fitted the quarry with supernatural peculiarities but now, watching him as he stood, entranced by pottery fired before the dawn of Western civilization, he seemed nothing but what he was. An ordinary man with a more than ordinary interest in things considered beautiful by a minority.

And yet he held knowledge which made him the most dangerous man to the security of the West.

"Got him!" Earlman's whisper was triumphant. "You did it again, Don! You called it right on the nose!"

"Get into position." Gregson didn't take his eyes from the slight figure he had hunted so long. "Stand by in case he makes a break for it. You know what to do."

"I know." Earlman hesitated. "Bronson?"

"I'll take care of him."

Don waited as Earlman slipped away, gliding past the cases to lean casually at the top of the far stairs. He sensed the other's relief and understood it. They had worked together for eight years and his failure would, in part, have been shared by Earlman.

But he had not failed.

Savoring the sweet taste of success he walked forward half-conscious of Bronson at his heels. Klieger did not turn. He stood, caressing a shallow, wide-mouthed bowl in his hands, eyes intent on the still-bright colors.

"Klieger!"

Slowly he set down the vase.

"Don't run. Don't fight. Don't do anything stupid." Don's voice was a grim whisper. "You can't get away."

"I know."

"Just in case you're wondering I'm from the C.I.A."

"I know."

"This is the end of the line, Klieger."

"I know."

The calm, emotionless tones irritated Gregson. The man should have complained, argued, anything but the flat baldness of the repeated statement. Savagely he gripped a shoulder and spun Klieger round to face him.

"Do you know everything?"

Klieger didn't answer. Heavy lids dropped over the eyes and Don remembered how Levkin had described them. "Remarkable" the owner had said, but the word was misleading. They were haunted. There was no other description, no other word.

Haunted.

"What are you going to do with me?" Klieger opened his eyes and stared up into the grim face of the hunter. Don shrugged.

"Why ask? You're the man who is supposed to know everything."

"I am a clairvoyant," said Klieger calmly. "I can see into the future, but so can you. Do you know everything?"

"I—" Don swallowed. "*What did you say?*"

"How else would you have known that I was here? And I mean know, not guess. You were certain that you would find me as certain as I am that—"

"Go on."

"You have the talent. By knowing that I would be here at this time you 'saw' into the future. Not far, perhaps, not too clearly, but you 'saw'. What other proof do you need?"

"But I simply had a conviction that—Is that how clairvoyancy works?"

"For you, obviously yes. For others, perhaps not exactly the same. But when you are convinced beyond any shadow of doubt that, at a certain time a thing will happen, or that a thing will happen even if the exact time is not too precise, then you have the gift which General Penn values most highly." Klieger gave a bitter smile. "Much good may it do you."

Don shook his head, conscious of receiving knowledge too fast and too soon. At his elbow Bronson shifted his weight a little, poising on the balls of his feet. Around them was a clear space as the other visitors moved down the line of cases. The three of them stood in an island of isolation.

"I am not coming back with you," announced Klieger. "I have had enough of Cartwright House."

"You have no choice."

Klieger smiled. "You forget," he pointed out gently, "it isn't a question of choice. It is a simple question of knowledge. I shall never see the general again."

Bronson made an incoherent sound deep in his throat.

He was fast, incredibly fast, but Don was even faster. Warned by some unknown sense he spun as the gun flashed into view, snatching at the wrist as it swung level, twisting and forcing the black muzzle from its target with viciously applied leverage. Muscles knotted then the bone snapped with the dry sound of a breaking stick. Bronson opened his mouth as the gun fell from nerveless fingers then Don slashed the hard edge of his palm across the nerves in the neck and the mute collapsed.

Quickly Don scooped up the gun and heaved Bronson to his feet, supporting the unconscious man as he fought mounting tides of hate. Hate for Bronson who lived only to take revenge on the world for his disability. Hatred for Penn who could find a use for the psychopathic mute and others like him. Licensed murderers in the sacred name of expediency; safe because they could never talk.

Earlman had seen what the others in the gallery had not. Running forward he met the blaze of Gregson's eyes.

"Get rid of this thing, fast!"

"So he had to try it." Earlman relieved Don of the dead weight. "Penn is going to love you for this."

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Don sucked air, fighting to rid himself of hate. "Take him back to the hotel. I'll worry about Penn when I have to."

"And Klieger?"

"I'll take care of him."

Don had almost forgotten Klieger in the savage fury of the past few minutes. He found him standing by one of the exhibits, staring at a relic of the past as if he were trying to drink its beauty and impress its image on his brain. Gently he picked up the piece, a man entranced by the artistic perfection of ancient craftsmen and, looking at him, Don felt his stomach tighten with a sudden, sick understanding.

Penn didn't trust women. The receptionist was a man as were all his personnel. He took one look at Don then lunged for a buzzer.

"Why bother?" Don headed past him towards the inner office. "Just tell the general that I'm on my way in."

"But—?"

"How did I get this far without being stopped?" Don shrugged. "You figure it out."

Penn wasn't alone. Earlman, more haggard than ever, sat smoking unhappily and Don guessed that he had been receiving the full weight of the general's anger. He grinned as the door slammed shut behind him.

"Hi, Max, you look as if you've been having a bad time."

"Don!" Earlman lunged to his feet. "Where have you been? It's more than a week now. Where's Klieger?"

"Klieger." Don smiled. "At this moment he is somewhere in Soviet territory being interrogated by every lie-detection device known to man."

For a moment there was a deathly silence then Penn leaned forward.

"All right, Gregson, you've had your joke. Now produce Klieger, or take the consequences."

"It's no joke." Don stared grimly into the general's eyes. "That's what I've been doing this past week. Talking to Klieger, fixing his passage, dodging your hunters."

"Traitor!"

Don didn't answer.

"You dirty, stinking traitor!" Suddenly Penn became icy calm and his calmness was more terrible than his rage. "This is a Democracy, Gregson, but we know how to protect ourselves. You should have gone with Klieger to the safety of your friends."

"Friends! You think I did it for them?" Don looked down at his hands, they were shaking. Deliberately he sat down, lit a cigarette, waited for his anger to pass.

"You demand loyalty," he said. "Blind, unswerving, unthinking loyalty. You think that those who are not with you must be for the enemy but you are wrong. There is a greater loyalty than to an individual, a nation or a group of nations. There is a loyalty to the human race. One day, please God, both sides may realize that."

"Don!"

Earlman leaned forward. Gregson gestured him back to his chair.

"Just listen, Max, you too, general. Listen and try to understand."

He paused, dragging at the cigarette, his broad-planed face revealing some of his fatigue.

"The answer," he said, "lay in the Ming Vase."

"The one Klieger stole from the antique shop?" Earlman nodded. "What about it, Don? Why was it important?"

He was, Don knew, acting as a barrier between him and the wrath of the general and he was suddenly glad that he was there. Penn, alone, might never have found the patience to listen.

"Klieger can see into the future," continued Don. "Never forget that. He was the star 'resident' at Cartwright House and stayed there for ten years. Then, for no apparent reason, he decided to take off. He did. He stole money—he had to live, and he stole a vase, to him a thing of wondrous beauty. The answer lies in why he did it."

"A thief!" Penn snorted. "He was a thief. That's the answer."

"No," said Don quietly. "The reason is that time was running out—and he knew it!"

They stared at him. They didn't understand, not even Earlman, certainly not Penn and yet, to Don, it was all clear. So ghastly clear.

"What a man does is determined by his character," said Don. "Given a certain stimulus he will react in a certain way—and this is predictable. Think of Klieger and what he was. Meek, mild, inoffensive, willing to do as he was told without question. He did it for ten years while his talent was being trained so that he could 'see' further and clearer into the future. Then, one day, he 'sees' something which drives him desperate.

"Desperate enough to break the habits of a lifetime. He persuaded the others to help him escape. They thought that he was doing it to help them, perhaps they wanted to prove something, that isn't important now. Klieger is. He walked out. He stole. He tried to fill every waking hour with what he considered to be the ultimate of beauty. A different man would have gambled, drank, chased women. Klieger loves old and precious things. He stole a Ming vase."

"Why?" Despite himself Penn was interested.

"Because he saw the ultimate war!"

Don leaned forward, the cigarette forgotten, his eyes burning with the necessity of making them see what he knew was the truth.

"He saw the end of everything. He saw his own death and he wanted, poor devil, to live a little before he died!"

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It made sense. Even to Penn it made sense. He had seen the secret records, the breakdown of a man's character, the psychological dissection and the extrapolations. Security was very thorough.

"I—" Penn swallowed. "I can't believe it."

"It's the truth." Don remembered his cigarette. "He told me—we had plenty of time for talking. How else do you think we managed to catch him? He could have remained free forever had he tried. But he was tired, afraid, terrified. He wanted to see the exhibition—and he expected to die by Bronson's bullet."

"Now wait a minute!" Earlman frowned, a crease folding his forehead. "No man in his right mind would willingly go to his death. It doesn't make sense."

"No?" Don was grim. "Think about it."

"A bullet is quick and clean," mused Earlman. "But he didn't die! Bronson was stopped!"

"That is why I turned 'traitor'." Don crushed out his cigarette. "By stopping Bronson I proved that the future is a variable, that even an expert clairvoyant like Klieger can only see the probable future, not the inevitable one. It gave us hope. Both of us."

He rose, looking down at Penn slumped behind his desk, trying not to let the hate he saw in the general's eyes disturb him. He had no need to worry.

"It had to be. The pattern must be broken if we are to avoid the future Klieger saw. So I gave him to the Reds—he was willing to do his part. They will learn the truth."

"They will copy us!" Penn reared to his feet. "They will form their own project and we will lose our greatest advantage. Gregson, do you know what you have done?"

"I've opened a window to the future—for them as well as for us. Now there will be no ultimate war."

"Smart!" Penn didn't trouble to hide his sneer. "You're so smart! You've taken it on yourself to do this without authority. I'll see you dead for this!"

"No, general." Don shook his head. "You won't see me dead."

"That's what you think. I'll have you shot!"

Don smiled, warm in the comforting knowledge of his new awareness.

"No," he said. "You won't have me shot." ■

IN TIMES TO COME

We haven't heard from John Berryman anywhere near as often as I'd like to . . . but he's got a novelette coming up next month titled "The Trouble with Telstar."

The basic plot of the story is obvious from the title—but the real function of an author always was, is, and will be that of imagining in greater detail, with more clarity, or to a conclusion that the reader hadn't the time and/or information to work out. Berryman's come up with some beautiful problems. At what point does it become economically possible—allowing the hardware has been developed—to send a man up to fix the communication satellite? And who do you send —an astronaut or an electronics engineer? A guy who knows how to work in space—or someone who knows how to trouble-shoot a Telstar?

Also coming, after lo! these many years—binders for the ANALOG collectors. I've gotten gripes on the new size, based on the fact that the larger, thinner format lacks the rigidity necessary to standing on a bookcase shelf. I agree; too bad —but that's what the economic facts of publishing life impose. The binders coming up will, I think, solve the problem. They're the five-sided-box type, not the loose-leaf type; they'll be done in black and silver, will each hold six issues, and will sell for $2.95 apiece.

The regular ad for them isn't on hand at this writing—that's going to have an engineering-type sketch showing the dimensions and specs on the things.

Having some twenty-five years of bound volumes of ASF in my personal file—thirty-three years here at the office—I'm in a position to state that binding the copies isn't as satisfactory as boxing them, for long-term storage.

More data on the box-binders, and how to order them will be published next month. ■

THE EDITOR

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THE LAST OF THE ROMANY

Sometimes a people may die off . . . but it may be that the idea they held was much too good to die . . .

by NORMAN SPINRAD

"It's been a long hot journey," said the man with the waxed mustache. "A Collins please, bartender."

The fat bartender reached over to the console, punched the "Collins" button, and asked "Gin, rum, vodka or grahooey?"

"Gin, of course," said the man with the waxed mustache. "A *grahooey Collins indeed!*" He lit up a large olive-green cigar.

The bartender punched the "gin" button, and tapped the serve bar. The clear plastic container of cloudy liquid popped up through the serving hole in the bar.

The man with the waxed black mustache looked at the drink, and then at the console, and then at the bartender. "Do not think me rude, my friend," he said, "but I've always wondered why there are still bartenders, when anyone could press those silly buttons."

The bartender laughed, a fat good-natured laugh. "Why are there bus drivers on robot buses? Why are there brewers when the beer practically brews itself? I guess the government figures that if everyone who was unnecessary was fired, they'd have a hundred million unemployed on their hands."

The man with the mustache, who called himself Miklos, toyed with the battered guitar, which leaned against the bar. "I'm sorry my friend, for my remark," he said. "Actually, bartenders are still useful. Could I

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talk to that machine? And they still don't have an automatic bouncer."

"Oh?" said the bartender, leaning close to Miklos. "I was in Tokyo last year, and there they have a great padded hook that drops from the ceiling, grabs a drunk, and heaves him out the door. All untouched by human hands. Ah, science!"

Miklos scowled, and then brightened. "Ah, but the bartender still must decide who to bounce! A very delicate task, not to be trusted to a machine. Therefore, a bartender will always be necessary. Another Collins, please."

"Why are you so concerned with my usefulness?" asked the bartender, punching out another Collins.

The man with the waxed black mustache and the weather-tanned face became very serious. "It is one of the things I search for in my travels," he said. "It is very important."

"What is?"

"Men who are still useful," said Miklos. "They are like rare birds. When I spot one, it makes my whole day. I'm sort of a people watcher."

"You travel a lot?" asked the bartender, with a little laugh. "You must be one of the idle rich."

"No," said Miklos without smiling. "It's part of my job to travel."

"Job? What kind of job? There are no more traveling salesmen, and you hardly look like a pilot—"

Miklos puffed thoughtfully on his cigar. "It is a hard thing to explain," he said. "Actually, there are two jobs. But if I succeed in one, the other is unnecessary. The first job is to search."

"To search for what?"

The man with the waxed mustache picked up his guitar and fiddled with the strings. "To search," he said, "for the Romany."

"The what?"

"The Romany, man! Gypsies."

The bartender gave him a queer look. "Gypsies? There aren't any Gypsies left. It wouldn't be permitted."

"You're telling me?" said Miklos, sighing. "For fourteen years I have searched for the Romany. I've hitched, when nobody hitches, I've bummed when nobody bums. I've looked in fifty states and six continents. I even went to the Spanish caves, and do you know what? They have a big mechanical display there now. Robot Romany! Flamenco machines. The things even pass a metal hat around. But the Romany are gone. And yet, some day, somewhere . . . Maybe you could . . . perhaps you would . . . ?"

"Me?" said the bartender, drawing away from the man with the mustache.

"Ah, but of course not. Nobody knows. And of course, everyone thinks I'm crazy. But let me tell you, my friend, crazy is strictly relative. I think you're all crazy. Nothing personal, you understand. It's this dry, clean, shiny Romany-killing world that's crazy. But come close, and I'll let you in on a secret."

Miklos stuck his face in the bartender's ear. "They have not killed the Romany", he whispered. Then louder: "I am the last Romany. That's the other job, to keep it all alive until I can find them. It's a good joke on the world. They try to kill the Romany, and when they fail, they try harder. But it is good for them that they do not succeed, for it is the Romany that keeps them alive. They don't know it, but when I am gone, they will die. Oh, they'll walk around in their nice, antiseptic cities for a few hundred years before they realize it, but for all practical purposes, they'll be dead."

"Sure," said the bartender. "Sure."

The man with the waxed black mustache frowned heavily. "I'm sorry," he said. "Sometimes I forget that I'm crazy, and then I become crazier. A neat paradox no?"

"You sound like an educated man," said the bartender, "a not-stupid man. How come you can't get a job?"

Miklos raised his head proudly. "Can't get a job! Sir, before I became Miklos, the Last Romany, I was assistant vice president in charge of sales for General Airconditioning. I am a moderately wealthy man. I know what success in this boring world is. You can have it."

"But with your money . . ."

"Bah! I wanted to see the exotic Orient, for example, so what was there? Tokyo was New York, Hong Kong was Chicago, Macao was Philadelphia. Far Samarkand is now a Russian rocket port. It's all gone. The Baghdad of the Caliphs, the China of Kubla Khan, far Samarkand, Cairo . . . Oh, the cities are still there, but so what? They're all the same, all neat and clean and shiny."

"You ought to be glad," said the bartender. "They cleaned up the opium traffic and the prostitution. They licked malaria and yellow fever—even dysentery. They got the beggars off the streets, and built sanitary markets for the street vendors. I was in Tokyo, as I said, and it's every bit as modern as New York."

Miklos snorted cigar smoke. "And while they were at it, they replaced the Caliphs and Sultans and Khans with City Managers. Feh!"

"Well," said the bartender, "you can't please everybody. Most folks like things the way they are."

"They think they do. Ah well, I've got things to do. Can you tell me where there's a playground?"

"A playground? You wanna play golf or something?"

"No, no, a *children's* playground."

"There's one three blocks west of here," said the bartender, "But what do you want there?"

"It's part of the job, my friend," said Miklos, getting up and hoisting his guitar to his shoulder. "It keeps me from thinking too much and doing too little, and besides, who knows, maybe it does some little good. Goodby." He left the bar whistling a *chardash.*

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"A nut," mumbled the bartender, tossing the used containers into the disposal. "Seems harmless enough, though."

The playground was the standard model, one block square, surrounded by a six-foot force-fence, with one entrance on each side. In addition to the usual exponential hopscotch board, force-slides and basketball grid, there was some newer equipment, including a large tri-D, and a robot watchman. Most of the children were seated on benches in front of the tri-D watching "Modern Lives," the playground educational series. They seemed quite bored, except when, as a sop to their frivolity, someone was hit over the head.

The man with the waxed black mustache and the battered guitar walked through the gate. He was noticed only by the robot watchman.

"Sir," rasped the robot, "are you the parent or guardian of any of these children?"

Miklos blew a smoke ring at the robot. "No!"

"Peddlers, beggars, salesmen, roller skates, pets and children over twelve years of age are forbidden in the playground," said the robot.

"I am not a peddler, beggar, salesman, roller skate, bicycle, pet or child over twelve," said Miklos, who knew the routine.

"Are you a sexual deviate?" asked the robot. "Sexual deviates are prohibited from the playground by law, and may be forceably removed."

"I am not a sexual deviate," said the man with the mustache. Predictably, the robot stood there for a moment, relays clicking confusedly, and then rolled away. Miklos entered the playground, threw away his half-smoked cigar, and sprawled himself on the last bench in front of the tri-D.

He strummed a few random chords on the guitar, and then sang a staccato song in Spanish. His voice was harsh, and his playing, at best, passable, but both were loud and enthusiastic, so the total effect was not unpleasing.

A few of the younger children detached themselves from the group around the tri-D and grouped themselves around Miklos' bench. He went through "Santa Anna," some very amateurish flamenco, and an old Israeli marching song. By the end of the marching song, all but the oldest children had gathered around him. He spoke for the first time. "My name is Miklos. Now my friends, I will sing for you a very nice little song about a rather nasty fellow. It is called 'Sam Hall'."

When he got to the part of the chorus which goes: "You're a buncha bastards all, damn your eyes," the robot came rolling over at top speed, screeching "Obscenity is forbidden in the playground. Forbidden. No child must say naughty words. No obscenity. Will the child who said the bad words please stop."

"I said the bad words, you pile of tin," laughed Miklos.

"Please stop using obscenity," croaked the robot. "Obscenity is forbidden to children."

Miklos lit a cigar and blew a huge puff of smoke at the robot. "I am not a child, you monstrosity. I can say what I please." He grinned at his appreciative audience.

Relays clicked frantically. "Are you a sexual deviate? Are you a beggar, saleman or peddler? Are you a child over twelve?"

"We went through this already. I am none of those things. Get out of here, before I report you for interfering with the civil rights of an adult human."

More relays clicked frantically. There was a slight smell of burning insulation. The robot wheeled off, careening crazily. It stopped about a hundred yards away, and began to mumble to itself.

Miklos laughed, and the children, all of whom were now clustered about him, roared with him.

"And now, my friends," he said, "let us talk of better things: Of pirates and khans and indians. Of the thousand and three white elephants of the King of Siam. Of the Seven Cities of Gold, and the great Caliph Haroun-al-Rashid."

"Have you been to all those, mister?"

"Are you a pirate?"

"What's a caliph?"

Miklos spread his large hands. "Wait, wait, one at a time." He smiled. "No, I am not a pirate. I am a Romany."

"What's a Ro . . . ?"

"Romany! A gypsy, my young friend. Not so long ago, there were thousands of us, rolling all over the world in bright red and yellow wagons, singing and playing and stealing chickens. Now I am the only one left, but I know all the stories, I know all the places—"

"You ever steal a chicken, mister?"

"Well . . . No, but I've stowed away on planes, even on a ship once. Do you know what that would have meant in the days of the pirates? Sir Henry Morgan would have made me walk the plank!"

"Walk the . . . plank?"

"Yes, he would've stroked his dirty black beard, and said: 'Miklos, ye scurvy bilge-rat, ye'll jump into the drink, and be ate by the sharks, or I'll run ye through with me cutlass!' "

"Couldn't you call a cop?"

Miklos grimaced and twirled the ends of his mustache. "A cop! Sir Henry would've ate one of your cops for breakfast. And at that, he'd be getting off easy. You know what Haroun-al-Rashid would've done? He'd have his Grand Vizier turn him into a camel!"

An older boy snickered loudly. "Aw, come on, ya can't turn a cop into a camel."

"I can't, and you can't, and maybe nobody today can. But in those days, in Baghdad! Why, anyone could!"

Most of the older children wandered away, but a hard core of six-and seven-and eight-year-olds remained.

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"You must believe," said Miklos, "and then you can do these things. Fifty years ago, you could cross the world with your thumb. Now they say it's impossible. But, my little friends, I know better. I have done it. How? Because I am a Romany. I believe, even if they say I'm crazy."

"Wow mister, Romanies is smart, huh?"

"No smarter than you. In fact, you can only do these things if you're a little stupid. Stupid enough to believe that somewhere, sometime, there still is a Baghdad, and Samarkand is still Far. You must be stupid enough not to care when the police and the Chairmen of the Board say you're crazy. And if you believe hard enough, and are crazy enough . . ."

"What, mister?"

The man with the waxed black mustache sighed, and then he leaned close to the circle of small heads and whispered: "If you believe hard enough, and care long enough, and are crazy enough, and become nice and wicked, then some day you will get to the Spanish Main, and the Seven Cities of gold, and the magic city of Baghdad, where there are no robots or schools, only magicians and wild black horses. And some day, you will see Far Samarkand, shining white and gold and red above the sands of the desert. And, little friends, if you are especially dirty, and never, never wash behind your ears, and only brush your teeth once a day, and don't watch the tri-D, and say four bad words a day for a month, and dream always of the lost far magic places, some day you will wake up, early on a cool autumn morning, and you will be a Romany!"

Miklos picked up the guitar. "And now, my little Romany, we will sing."

And he played the old songs, and sang of the far places until the sweat dripped onto his mustache. Then he pulled out a red bandanna, wiped his face, and played some more.

For two hours, he played and sang, and told the old tales.

He was just finishing the story of Atlantis, when the cop arrived. The cop was dressed in the usual blue tunic and shorts, and the usual scowl. "What the hell's going on here?" he said.

The robot came wheeling over, moaning, "Obscenity is forbidden in the playground. Obscenity is—"

"Shaddap!" said the cop.

The robot shut up.

"All right, bud," said the cop, "what do you think you're doing?"

"Just singing a few songs, and telling a few stories," said the man with the waxed mustache meekly.

"You're disturbing a public playground," said the cop. "I think I'll run you in."

A little sparkle returned to the man with the mustache. "Is that a crime, officer?" he said.

"No, but . . ."

Miklos chewed on his cigar. "Then I guess you'll be on your way," he said.

"Not so fast," said the cop. "I can still run you in for vagrancy."

The man with the mustache grinned, and then permitted himself a large laugh. "I'm afraid not, my friend. No indeed, I'm afraid not." He reached into his pocket and pulled out a role of wet, soiled bills. He counted out two hundred dollars, and shoved them under the cop's nose. "See, my friend? I am hardly a vagrant. Well, my little friends," he said, turning his back to the cop, "I must be going, before there is any more trouble, and I am tempted to turn this worthy officer of the law into a you-know-what. Good-by, my friends. Remember the Romany."

The children grinned. The cop stood there The man with the waxed black mustache hoisted his guitar to his shoulder, and slowly walked out of the playground, whistling loudly.

The early morning sun shone in through the large picture window, bathing the bar in bright yellow light. The bar was empty, except for the bartender and a young man with a detached, faraway look. The young man, who was wearing the gold and black uniform of the Space Corps, sat at one end of the bar staring out the window and sipping a beer.

Miklos stepped in, the open door admitting a blast of hot air into the air-conditioned room. "Hello, my friend," he said, sitting down two seats away from the young Spaceman. "A beer, please."

The bartender pressed beer, and the plastic stein appeared in front of Miklos. Miklos took a long drink. "The morning is the best time for a good cold beer," he said. "Too bad so few people recognize it's beauties." He glanced at the young man. The Spaceman gave Miklos a funny look, but not one of distaste. He said nothing, and continued to stare out the window.

"Did you find the playground?" asked the bartender. The Spaceman smiled a twisted smile.

"Of course," said Miklos, lighting a cigar. "No trouble at all. That is, except for a cop that tried to chase me away. But he was little trouble." He pointed to his head. "Not too bright, you know."

The Spaceman chuckled softly.

"You still haven't told me what you did there," said the bartender.

The man with the mustache thumped his guitar. "I played this thing, I sang, I told the kids a few stories."

"What for?" asked the bartender.

The young man got up, and sat down next to Miklos. "I know what for, don't I?" he said, smiling.

Miklos laughed. "If you say you do."

"Say," said the bartender, "you're a Spaceman. You been around, no?"

"I suppose I have."

"Well then," said the bartender, "maybe you can

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help our guitar friend here. He's looking for something."

"Oh?" said the young man with the faraway stare. He seemed to be suppressing something between a snicker and a grin.

"Yeah," said the bartender, laughing, "Gypsies!"

The Spaceman did not laugh. He ignored the bartender, and turned to Miklos. "You are looking for Gypsies?"

"Yes," said Miklos soberly. "Yes, I am looking for Gypsies."

"For the Romany?"

Miklos stared hard at him. "Yes, the Romany."

The Spaceman drank the last of his beer. "It is a hard thing," he said, "to find Romany these days."

"I know, I know," said Miklos, resting his head in his hands. "For fourteen years I have looked. Fourteen years, six continents, and God knows how many countries. It's a long time—a long sweaty time. Perhaps too long, perhaps I am crazy, and there are no more Romany, and perhaps there never will be. Perhaps I should give up, and go back to being a vice president in charge of sales, or go to a psychiatrist, or—"

"I know a place," said the young man.

"A place?"

"A far place," said the Spaceman. "A place that no one has yet seen. Alpha Centauri. Or perhaps Sirus. Or Rigel."

"The stars?" said Miklos. "Nobody's ever been to the stars."

"Indeed," said the young man, smiling, "no one has ever been to the stars. What better place to find the Romany? Out there, in a land that is not yet in the travel tours, a land that no one has ever seen, the kind of land where the Romany have always gone. Somewhere out there, there are cities that put all the legends to shame. And magic, and wonder . . . The Universe has a billion worlds. Surely, on one of them there are Gypsies, on another Khans, on another ancient Baghdad."

"A very pleasant picture," said Miklos, lighting a cigar, "and probably true. But unfortunately, it's as possible to go to those worlds as it is to visit ancient Baghdad."

"Not quite," said the Spaceman. "On the Moon, they are building a faster-than-light starship. First stop Alpha Centauri. There will be others. Many others."

Miklos stood up. "A starship! Yes! I'll book passage right away. You wouldn't think it, to look at me, but I'm moderately rich." He stared out the window at the sky. "Perhaps I'll find them yet, out there."

"Of course," said the young man, "It's a government project, like the Moon, and Mars and Venus. As they say, there's only room for 'trained experts'."

"Of course," said Miklos, "of course . . . it's always that way. Always machines, or men like machines, always. But no matter! If those ships exist, there is a way on them. If the stars are there, there's a way to bum your way. If the Romany exist, some day, somewhere, I'll find them." He stood up, and slung his guitar over his shoulder. "I'm off for Canaveral," he said. "And then to the Moon, and then . . . Well, good-by and thanks."

The man with the waxed black mustache strode out into the sunny street.

"Thanks, pal," said the bartender. "You really got rid of that screwball. He was starting to worry me. You really knew what made him tick."

"I ought to," said the Spaceman.

"Whaddaya mean?"

"Well, once there was a kid in Springfield, Ohio, in fact the kid was me. And this kid was like all the other kids in this world, a nice, packaged future member of a nice packaged society. And then one day, maybe eleven years ago, a crazy guy with a mustache blew into town, and told that kid a lot of tall tales about a lot of far places. Something changed in that kid that day—a very small change. But it got bigger and bigger every year, until now that little change is the whole person. And here I am, on my way to Centaurus."

"You mean there really is a starship?"

"There sure is, and you know something? Somehow, some day, in some highly illegal manner, that guy is going to get on it." The Spaceman looked out the window as if he were already on his way to Centaurus.

"What'll they do to him when they find him?" asked the bartender.

The Spaceman looked at him, a strange softness in his eyes.

"Only a certain rare kind of man can go somewhere no one's ever seen. You can't package that kind of man. You can't grow him in controlled schools and mold him on canned dreams. You've got to beat him and kick him and laugh at him and call him crazy. And if someone has whispered certain things in his ear at a critical time, you have a man who will go to the stars."

The young man glared at the bartender.

"What will we say to him, when we find him on the ship? What else, but 'Welcome, Miklos. Welcome home'." ◙

TECHNOLOGICAL HISTORY QUIZZ

Can you name:

1. The first commercially sucessful thermoplastic material. (And still the cheapest!)
2. The first successful thermosetting plastic material. (And still noted for extreme chemical stability.)
3. The first commercially successful foam plastic. (And the most widely used—a familiar homecrafts material, frequently used as a packaging material for meats and foodstuffs.)

Answers on Page 93

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Observational Difficulties

Continued from page 16

the martian equatorial bulge of 1/192 supports this conclusion. In short, Mars evidently possesses a fairly homogenous interior which would presuppose an early stabilization and presumedly an early secession of tectonic activity.

As opposed to this, if we turn our attentions to the lunar surface and observe the high and continuous mountain ranges existing there, where there is a similar homogeneity and less than half the surface gravity of Mars, we must conclude that there is no *a priori* reason why Mars may not have had a tectonic era. (Fig. 7). When we also consider that the earth and moon, which between them bracket Mars in virtually every sense of the word, are both graced by mountain ranges, the probability of mountain building on Mars becomes quite high.

But even postulating this, the stabilization of the interior must have occurred at a relatively early date and there is no present reason to assume any recent seismic activity. Since unlike the moon, Mars has a considerable atmosphere, then there must be weathering, and as the density of this atmosphere must have been considerably greater in the remote past, it follows that, if the tectonic activity ceased much more than perhaps 2×10^9 years ago enough time will have elapsed to complete the erosion of the system.

However, this erosion would not be comparable to that characteristic of earth. An indispensable concomitant of terrestrial erosion is the existence of waterways to carry the detritus to the lowlands and oceans in the forms of silts and sands. Lacking such waterways the martian erosion would be of the wind-scouring type which would tend to localize the spread of the eroded material by depositing it into the associated valleys. As the tops of the hills would weather, the valleys would fill and the inevitable result would be the formation of a relatively level plateau perhaps one or two thousand meters above the mean surface level. Only when this portion of the erosion was substantially complete would there by any considerable movement of material into the lowland plains.

Given enough time and the entire surface of the planet will be covered with a homogenous, drifting blanket of sand dunes. The fact that direct observation shows differences in marking refutes the idea that Mars may already have reached this terminal condition. Instead, we may legitimately infer the existence of several high plateaus separating somewhat protected lowland plains. The transition zone between the two areas would consist of a relatively narrow fringe where the dunes are beginning to overlap. Based on the accompanying photographs, we may be justified in concluding that 60% of the total surface area is embraced by these elevated plateaus. This compares favorably with evidence obtained from earth, where, if we count the eroded remnants of ranges, present day ranges and submerged oceanic ranges, we arrive at a figure of between 40-50% with another 20% still unknown.

This brings us to the question of the *canali*, without which no examination of Mars can be considered complete.

The supposition that those who claim to have seen these *canali* were either suffering from eyestrain or an overactive imagination is inadmissible. Any competent observer is aware of the nature of eyestrain and is capable of distinguishing within himself its symptoms. And that several of the observers who have reported seeing the *canali* had previously been disbelievers is a convincing argument against the thesis of overactive imagination. We therefore conclude that some phenomenon has been seen and that it is the proper interpretation of the phenomenon which is the problem, not the fact of the seeing itself.

Significantly, these unusual markings have consisted of not just one but two types of object. On the one hand there are the *canali*; long, straight lines spanning hundreds of kilometers, marching indifferently across plateau and plain, sometimes intersecting other *canali*, and occasionally fading into nothingness (Figs. 2 and 5). The other type of marking has received somewhat less attention but is just as important. If the first object is called a "canal," then to be consistent we must call the second an "oasis," since it is a regular, usually circular structure appearing at the nexus of one or more of the *canali*.

The chief source of puzzlement concerning these markings has been their regularity, which stands in direct contrast to the usual features of nature. It is on this basis that they have been attributed variously to intelligent beings, to wind troughs, to a drying and shrinkage of the surface, or, alternatively, to a progressive lessening of gravity over the eons and a consequent expansion of the planet itself.

As an alternative to these suggestions we once again focus our attention on the earth-moon system and the general conditions of the solar system as a whole. When once we do, it becomes almost routine to attribute the peculiar markings to meteoritic impacts!

First, the visually observable portion of the moon discloses something in excess of 50,000 impact craters, each of which is noteworthy by the regularity of its circular ringwall (Fig. 8). And though not sufficiently detailed to permit a count of such craters on the lunar backside, the Russian probe at least verified that the rear of the moon is similar to the visible portion. We therefore arrive at a total of not less than 75,000 craters on the moon. In addition, mounting evidence shows that the earth, too, has been subjected to its proportionate share of this celestial bombardment.

When we consider the composition of the solar system we must conclude that in all likelihood the ultimate source of these meteorites is the as-

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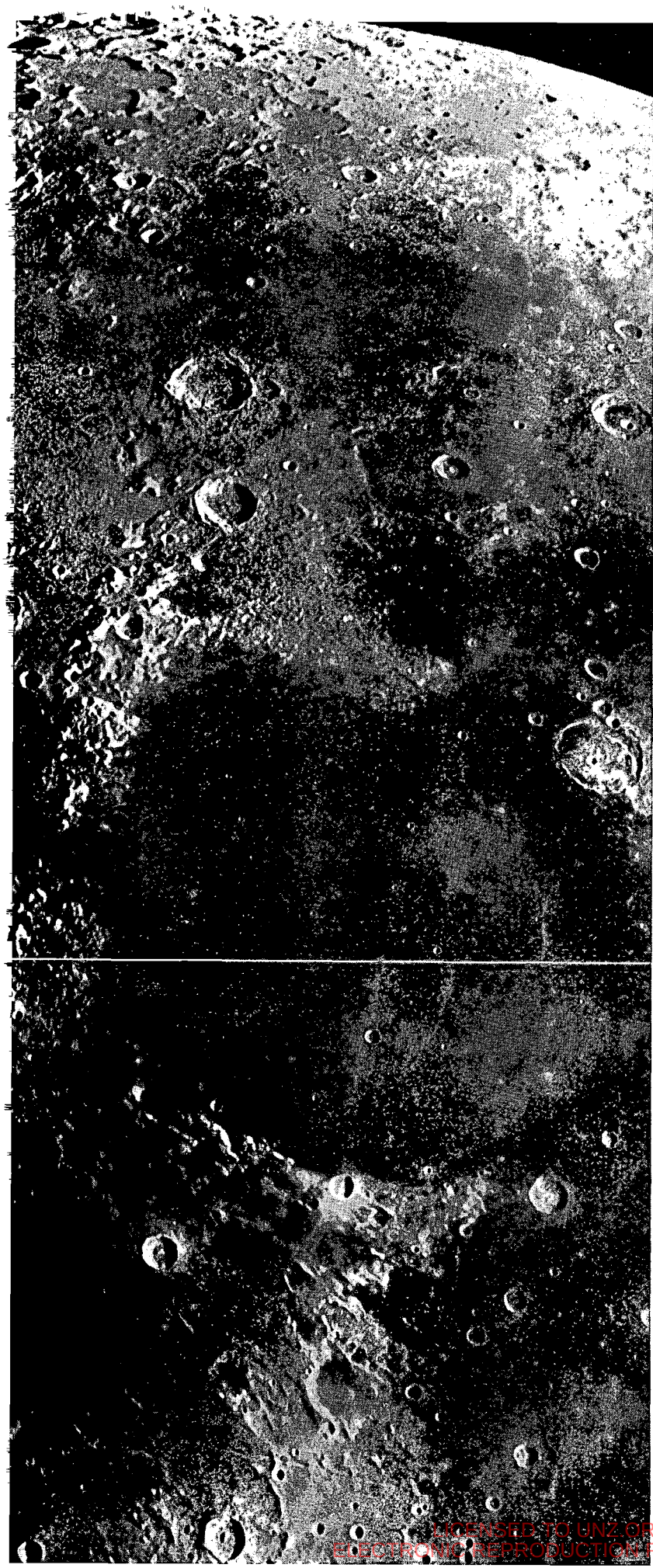

teroid belt which lies between Mars and Jupiter. If this is correct, then each of the meteorites impacting the earth or moon must first have passed through the orbit of Mars at some time in its history. If the earth or lunar impacting object happened to be a "male" asteroid, whose mean orbital distance is less than that of Mars, or a highly eccentric "female" asteroid, then the number of transits of the martian orbit prior to impact on earth could literally number into the billions.

If the moon is any criterion in this matter, than by possessing four times the surface area, Mars must have been struck by not less than 300,000 meteorites over the ages (Fig. 9), and the probability is that it would have been struck by a considerably higher number even than this. Allowing for a perfectly normal distribution in the sizes of these asteroids, it is a certainty that many of the scars thus formed would be visible to telescopic observation on earth. The regularity of the resultant ring-wall structure could easily be interpretable as "oases."

To obtain some idea of the actual conditions of impact we have first to consider the question of terminal velocity. Taking the escape velocity of Mars as being 5 km/sec exactly, and ignoring the atmosphere for the time being, it follows that this figure of 5 km/sec represents the minimum direct impact velocity. For a grazing impact the figure may be as low as 3.5 km/sec.

To arrive at either of these minimum figures it is necessary to assume the asteroid in nearly circular orbit about the sun and slightly inferior to Mars so that only the martian gravity need be considered. This

Fig. 7: Region of the Caucasus Mountains and Alpine Valley of Moon. These mountains are comparable in height to any of Earth.

MOUNT WILSON AND PALOMAR OBSERVATORIES

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is an unlikely situation and the probability is that some component of solar orbital velocity will be involved. To obtain the possible parameters for this situation, the mean orbital velocity of Mars is 24.159 km/sec. An orbiting object crossing the mean orbiting distance of Mars will have a speed falling somewhere between 24.159 and 34.166 km/sec, depending upon its deviation from a circular orbit. If the object happens to be in retrograde orbit with an eccentricity approaching 1., then the speed of convergence will approach 58.3 km/sec, with an additional 5.0 km/sec to be added as a consequence of the martian gravity. If Mars were at perihelion another 2 km/sec could be added to these figures, giving us an absolute maximum of 65 km/sec.

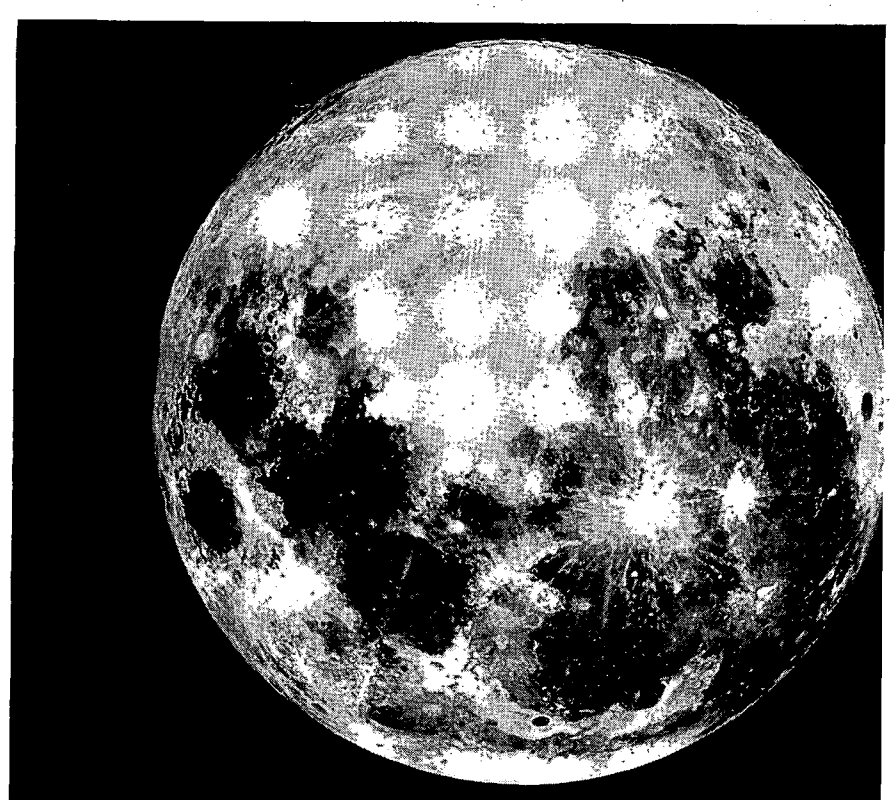
But while there is a theoretical spread of from 3.5 to 65 km/sec, on a statistical basis the angle of average convergence will range from zero degrees on a pursuit course to approximately 20° from a superior position. This would mean an average impact velocity ranging between 5.0 and 7.2 km/sec at the instant of entry into the martian atmosphere. By comparison, the comparable figures for earth would work out to between 11.19 and 14.94 km/sec, and for the moon to between 1.8 and about 5.0 km/sec, depending upon the position of the moon in its orbit about earth.

The assumption is that the Vredefort Crater of South Africa was formed by a nickel-iron meteorite approximately two miles in diameter. The average mass of such a meteorite is 7.3 gm/cm^3 so the gross mass must, therefore, have been 125.2 $\times$ 10^{15} gm. Again ignoring the effects of the atmosphere, impacting at 14 km/sec on earth, the total energy of impact would be 1.227 $\times$ 10^{29} ergs, or 5 $\times$ 10^{15} horsepower if a different type of comparison is desired! Impacting on Mars at 7 km/sec the figures would be 3.0 $\times$ 10^{28} ergs, or 1.25 $\times$ 10^{15} hp; approximately ¼ the energy of an earth type impact.

The retarding effect of the planetary atmosphere is a rather involved topic but the essentials are not too difficult. A body entering the atmosphere at hypersonic velocity piles the atmosphere up ahead of it. This atmosphere thereupon becomes in effect a portion of the gross mass of the impacting body. Therefore, irregularities in the surface of the meteorite itself are of little significance since the effectual surface is the leading edge of the piled up atmosphere. The kinetic energy which is lost in acquiring this piled up atmosphere is balanced by the increased mass of gases. That portion of the atmosphere which is thrown aside, as well as any portion of the meteoritic material eroded away by the passage represents a net loss to the system. Since the mass increases as the cube of the diameter, it is apparent that the larger the meteorite the less the effect of the planetary atmosphere. Thus, a meteor two or three meters in diameter will lose most of its kinetic energy in a passage through the atmosphere and will probably strike the surface with the force of a body in free fall, somewhere in the vicinity of 200 km per hour. A massive asteroid, on the other hand, will have no appreciable loss of velocity and the maximum effect would be a reduction from 1.227 $\times$ 10^{29} ergs to perhaps 1.2268 $\times$ 10^{29} ergs for an earth impact. As the mass of the martian atmosphere is only a quarter that of earth the effect would be proportionately less. In practice, therefore, we may ignore the effect of atmosphere on the more massive asteroids.

Turning once more to Fig. 5 and referring to the five dark craters in the center right of the photograph, the central crater of the three in line has an apparent diameter about 3/76

Fig. 8: Full phase photo of Moon showing dominant features and crater structures.



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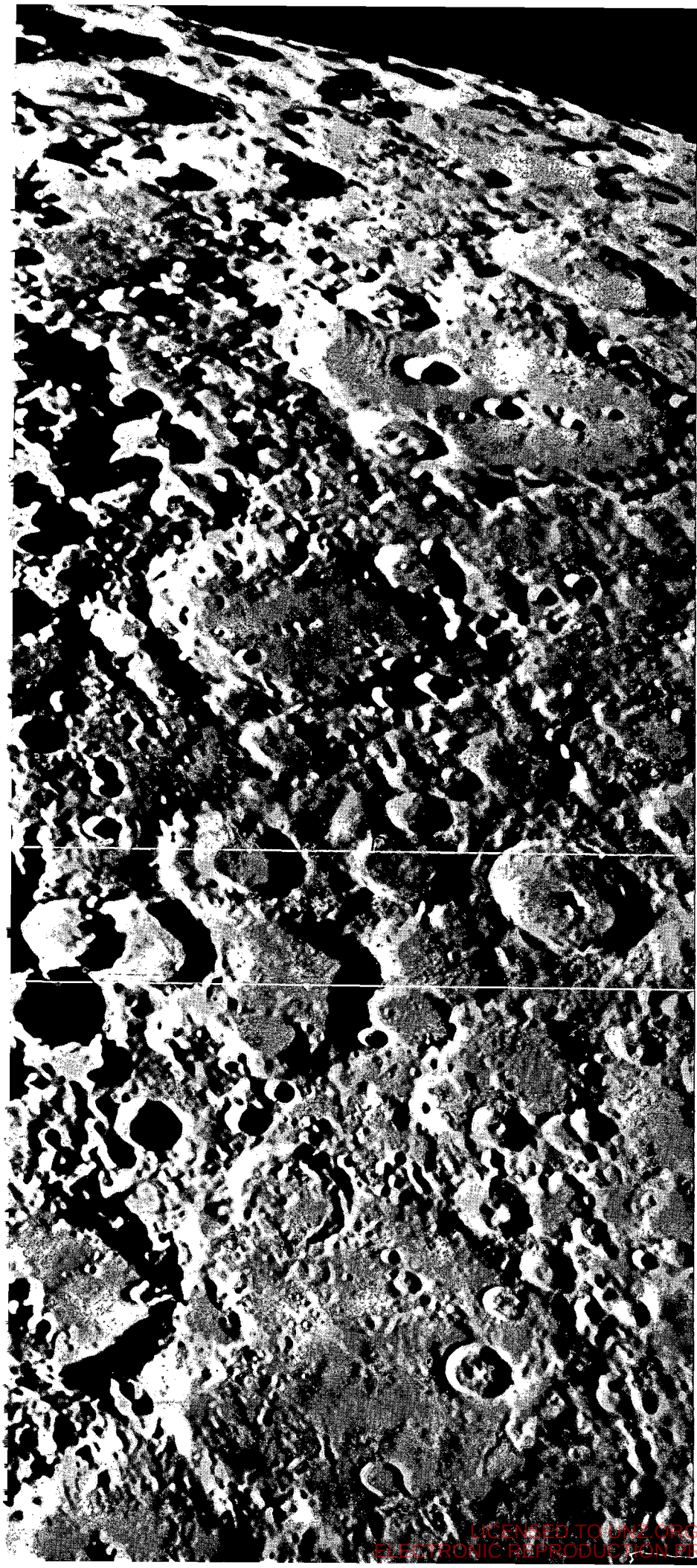

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that of the whole disk, which means it cannot be more than some 270 km (170 miles) in diameter. The smaller crater, which lies on the extension of the line formed by the three out into the plateau, has an apparent diameter 1/76 that of the disk and is, therefore, approximately 90 km (56 miles) across. Assuming the median impact velocity for Mars to be 7 km/sec, for earth to be 14 km/sec, and for the moon to be 5 km/sec, we arrive at a ratio of 1:4:8. In other words, if we have three craters, each 90 km across on the earth, Mars and the moon respectively, then to achieve this uniform crater size the Mars meteorite must be four times as massive as the earth meteorite and the lunar meteorite eight times as massive as the earth meteorite, or twice as massive as the martian meteorite. The somewhat indefinitely defined crater on the northeastern rim of Mare serenatitis (Fig. 10), has a minor axis of about 90 km and a major axis of about 112 km. The impacting asteroid must, therefore, have been about 2½ times the size of the asteroid forming the smaller of the two craters mentioned above. The deformation area of the crater Copernicus (Fig. 11) coincides roughly with the diameter of the other crater.

To carry the matter a step further, an analysis of the lunar surface shows evidence of the impact of several "super" meteorites whose diameters probably ranged upward of 70 km. Mare Serenatitis itself is one such instance. It shows the characteristic circular rim and the basaltic "flood plain" which also typify the intermediate sized lunar craters.

Fig. 9: Photograph of the Tycho and Clavius of the Moon. The surface of Mars would presumedly look like this were it not for the weathering effects of the atmosphere which would tend to smooth out some of the smaller craters. The larger craters would tend to remain indefinitely.

LICK OBSERVATORY PHOTOGRAPH

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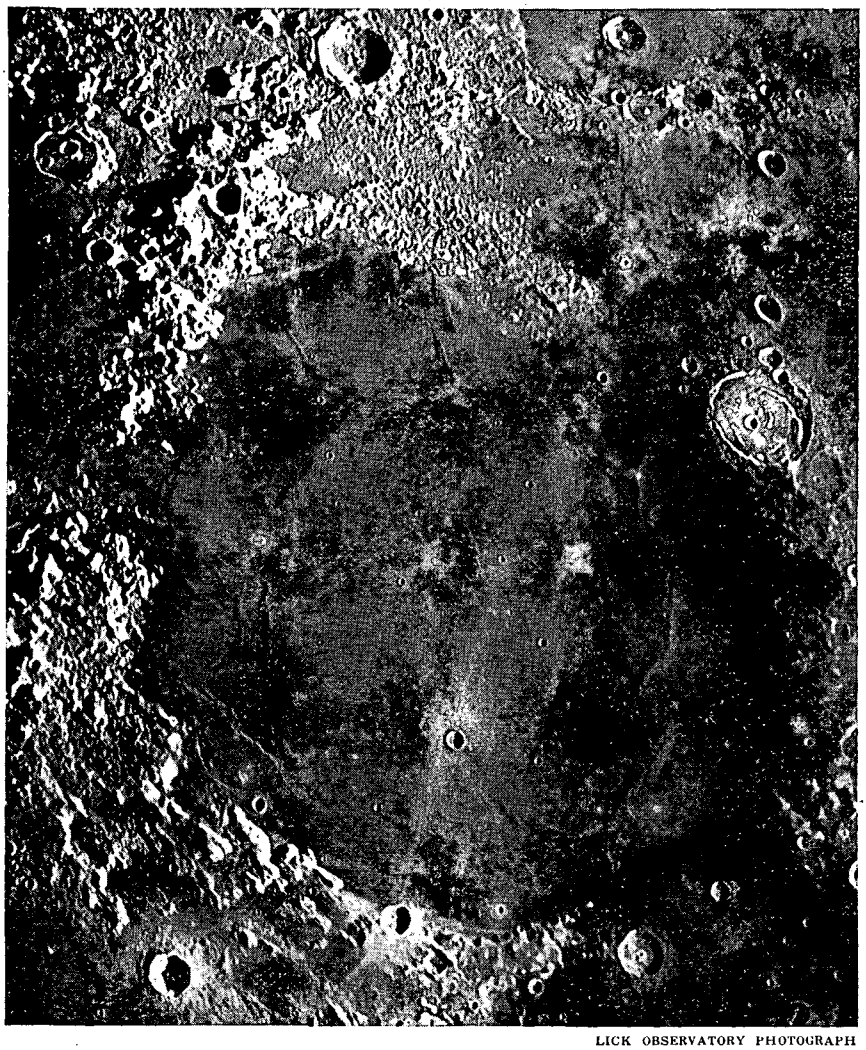
Counterpart objects on Mars, such as Lacus solis, *et al.*, bear so remarkable a resemblance that mere coincidence is virtually ruled out.

If the "oases" of Mars are impact craters, then logically the *canali* become associated ray systems comparable to that of Tycho on the moon. Evidently consisting of swathes of microtectites, the elevation of the ambient terrain is of no importance since the original material was cast off as flying ejecta. This makes it unnecessary to attempt evolving complicated explanations of the reason why the *canali* appear indifferent to variations of surface topography. The photograph of Mare serenatitis shows such a ray extending from the lower center to the upper right with arrowlike directness. To an observer looking through two atmospheres at a distance of 56 million km. this would be easily interpretable as an artificial structure. Nor would the difference in texture and coloration of the rays be a significant factor. The lunar background is quite dark. An albedo of only seven per cent corresponds to basalts and rough, dark surfaces. By comparison, the martian background is predominantly a light reddish. Any substance falling between these two extremes in reflectivity and texture would naturally appear light on the moon and dark on Mars.

The implications of all this so far as future physical exploration is concerned are rather interesting. Since the estimates of atmospheric composition and density naturally would be taken from the upper limits of the plateaus, it follows that the valleys would have from one to two thousand meters greater depth of atmosphere. A meteor crater of any considerable size which happened to be situated in one of the valleys could be expected to afford an additional depth of from five hundred to a thousand meters if lunar comparisons are applicable.

Considering the low average temperature on Mars and even allowing for an upper limit to the depth of the atmosphere, it is unlikely that any considerable amount of moisture could rise above the level of the plateaus and the majority would remain concentrated within the craters. Further, the oxygen concentration could be expected to reach its maximum at such points. There is a very real chance, therefore, that meteoritic impact craters will be the preferential sites for future bases on Mars. In fact, it is within the extreme limits of possibility that explorers could survive without the use of complicated breathing apparatus so long as they did not venture from the deeper craters. The potential advantages of such craters become obvious under the circumstances.



LICK OBSERVATORY PHOTOGRAPH

Fig. 10: The Mare serenatitis region of the Moon. Note the characteristic circular nature of the structure as well as the generally circular character of the ridges formed in the plain. These latter are probably indicative of molten basalts welling up from the interior and of various stages in the cooling process. Note the vaguely defined ray stretching diagonally across the photograph.

And now to climb out on a limb and wait for someone to chop it off. Since the initial submission of this article the Russians have successfully launched a Mars probe. Assuming all systems work properly and a clear telephoto is relayed back to earth, what can we logically expect them to see?

The main outlines have been discussed, but numerous details remain to be filled in. Along the elevated plateaus, for instance, we can expect to see occasional jagged spikes of antique pinnacles jutting through a powdery limonite surface. Meteoritic craters will pockmark the plateaus in irregular profusion, but only the

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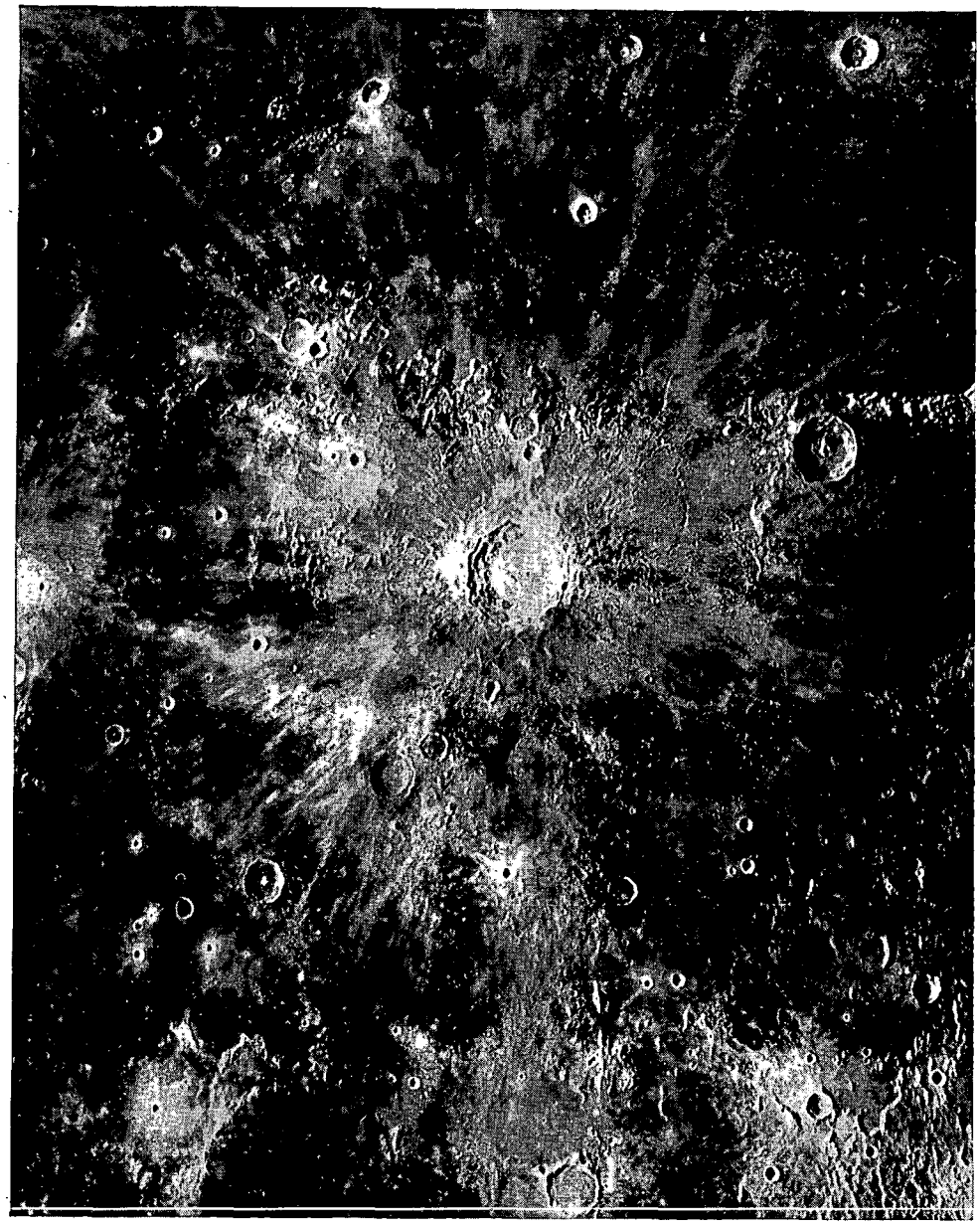
most recent will show a rigid outline. The talclike consistency of the wind-scoured granules will quickly obliterate all but the largest or latest craters. Perhaps here and there will be a volcano, formed of the stresses created by some meteorite impacting in the last few millennia. Downwind will be a region where wind drifted volcanic ash has lent a darker texture to the surrounding area. An occasional plume of smoke will seep forth to form a cloud of intermediate texture between the ice clouds and the dust clouds.

In the adjacent lowlands and in the craters formed by the super meteorites we will find the maximum concentration of residual water vapor and oxygen. A low, lichenlike vegetation may eke out a scanty existence in these regions, and if the panspermia theory is valid, possibly the life forms in adjacent craters will be totally different.

In contrast to the highland craters, those of the lowlands will have retained their steep sides reasonably intact over a considerable period of time. Being bounded by the high plateaus there will be little opportunity for the development of large scale weather patterns and even the denser atmosphere of the lowlands could hardly carry much dust.

This is no pretty picture; but it is likely to be the true one. In a few months or years we shall know. But as a last comment, let us suppose for a minute that by some combination of events Mars does not present a meteor-blasted surface. How then would astronomers of the coming generation be able to explain an earth and moon heavily scarified by repeated impacts, and at the same time explain a Mars which has not been? There would be a real problem!



MOUNT WILSON AND PALOMAR OBSERVATORIES

Fig. 11: The Crater Copernicus and surrounding region. Note faint ray tracery and the region of distortion and discoloration around the crater itself. Seen from any considerable distance the area would apparently have a light, irregular boundary, and an even lighter central core. Compare this with the crater as seen in the full phase photo of the Moon in Fig. 8, and then with the five craters in the dark region of Mars as shown in Fig. 5.

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Editorial

Continued from page 8

years or so, let alone the millions of light-years to other galaxies!

Nearly all the mass of a galaxy will be invisible to us.

The tiny proportion of the galactic mass that is formed into enormously luminous super-giant suns of mass tens of times Sol's will be all we can observe. Stars like Y Cygni, for instance, with a mass 17.2 times Sol's, and a luminosity thirty-six thousand times as great. Y Cygni, with a surface temperature in the order of 40,000°, is radiating away energy at so furious a rate that it obviously can't continue for any long period of time. With less than eighteen times the Sun's mass, and thirty-six thousand times the luminosity, it must exhaust its fuel supply in roughly 1/2,000th the time the Sun will take. If our Sun is good for 20,000,000,000 years, as has been suggested, then Y Cygni would burn out in about 10,000,000 years.

Now in terms of Man's written history, ten megayears is an unthinkably long period. But in terms of Man's evolutionary history, it's definitely "recent"; the first humanoid ancestors had evolved 10,000,000 years ago. And in terms of the history of the galaxy, ten megayears is about a week; our own galaxy seems to be about 10,000 megayears old.

Then all those remotely-visible, super-giant suns are (1) actually extremely rare in the galaxy, and (2) always very short-lived.

Now the "spiral structure" of the galaxies becomes more understandable; those super-luminous stars don't last long enough to become smoothly mixed! The normal, long-lived stars that shine steadily for billions of years make circuit after circuit around the galaxy, becoming distributed fairly evenly in a great disk of immense mass, and very low luminosity. The actual structure of the galaxies, then, *is not spiral.*

But . . . this raises the fascinating question of what it is that keeps creating new stars in galaxies—because clearly something must be continually replacing the burned-out super-giants. That question is, however, still very much wide-open to debate. The best current guess seems to be that some magneto-hydro-dynamic mechanism, working on the great magnetic field of the galaxy, causes jets of hydrogen gas to be ejected along two opposed and spinning lines—sort of like a lawn-sprinkler!—and that the super-giant stars, at least, are created in the paths of these vast jets.

However, the point at issue is the question of life and habitable planets in this—or other!—galaxy. And in this connection, the actual nonspiral structure of galaxies is most important—for it helps to be aware of the fact that there are vastly more small, low-luminosity, very-long-life stars than there are conspicuous, short-lived stars.

A star one thousand times as luminous as the Sun will have a "service life" of only millions of years; it can't serve to maintain the temperature of a planet long enough for life to evolve.

A star of the Sun's luminosity has an adequate service-life—as we have reason to know-for-sure! And any smaller star will have even longer, and even more stable radiation-life.

There is another important factor to consider, however; the volume of the zone around a star which would be maintained at a "habitable" temperature, during the time that the star was radiating stably. The combination of factors defines a space-time volume necessary before life can evolve—and if there are no planets in that space-time zone, no life can evolve.

A star like Rigel in Orion radiating some twenty thousand times as much as the Sun, a blue-white giant, won't be radiating *long* in *time*, but the volume of space around it which would be maintained at a habitable temperature would be stupendous.

Start with the Solar system for comparison; the zone from Venus' 'through Mars' orbits appears to be about the limits for water-based life; Jupiter and possibly Saturn could support ammonia-based life. Thus, for the Sun, the life-zone has a space-depth of roughly 800,000,000 miles.

Water and/or ammonia appear to be the only reasonably probable life-fluids possible. Hal Clement to the contrary notwithstanding—"Mission of Gravity," April, May, June and July 1953 issues—methane is not a very probably life-fluid; it's too poor a solvent, and is a nonionic solvent. The immense domination of hydrogen in galactic element-abundance pretty well assures that the fluids available on a new planet will be hydrides; the most common of all hydrides is H_2O, with NH_3(ammonia) and CH_4(methane) trailing rather badly. The abundance of fluorine in the universe is so extremely low that a planet with liquid HF seems extremely unlikely. And only the hydrides of the elements of the first row of the periodic table are liquid at planetary temperatures.

Now a star with ten thousand times the output of our Sun would—because of the inverse-square fall-off of radiation intensity—maintain an equal planetary temperature at just one hundred times the distance. Thus instead of roughly 70,000,000 to 700,000,000 miles—slightly farther out than Venus, and not quite as far as Saturn—that constitutes Sol's life-zone, a 10,000-sun-power star would have a life-zone from 700,000,000 to 7,000,000,000 miles. (Pluto is at 3,600,000,000 miles.) That gives one whale of a lot of volume for habitable planets—for when you multiply the radius by one hundred, you multiply the volume by 1,000,000! Start sprinkling planets with a salt-shaker technique—entirely at random—and you're practically certain to land several within that stupendous volume of space.

Unfortunately, while the probability of getting a planet in the habitable zone is high—it won't do life much good, since it won't remain habitable long enough for life to evolve.

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Going the other way, a star with 1/1,000th our Sun's output will reduce the habitable-zone distances to roughly 1/32nd of the Sun's—instead of our 70 to 700 million miles, only 2 to 20 million.

And this time the scale effects really start to bind! For the volume of habitably-warmed space goes down sharply to 1/30,000th or so of that of a Sun-type star.

With such a star, then, we have an enormous time-extent, so life would have plenty of opportunity to evolve . . . if there were a planet between those narrow limits! But the space-limits are now so narrow that the probability of an adequate planetary mass being found within them is also small.

For science-fictioneers, "habitable planet" has a variety of meanings, one of which includes the idea of a completely barren planet capable of conversion to terrestrial-type flora-fauna habitation. For instance, the Earth, before life first evolved, would meet that description, obviously. It only required that life be seeded here, and the conversion from the original methane-ammonia-water atmosphere to the present oxygen-nitrogen-water atmosphere was automatic.

By the time we have interstellar flight, we'll have a biological science capable of supplying some fast-reproducing bacteria capable of working a chain-reaction-exponential magic on such an undesirable atmosphere, and converting the entire planet in some five or ten years.

Now a planet of Rigel could not possibly have had time to evolve life; it never would have time before the star burns out in a few more megayears.

But . . . on the human scale of events, who'd worry about what happened a few megayears hence! We all know perfectly well that it's not true that "there'll always be an England!" for the simple facts of geology show that the Earth's crust heaves, twitches, slips and wrinkles every few million years. Certainly Manhattan Island isn't going to be around "always," either. But that doesn't mean it's impossible to build anything there, when you know it'll all be twitched away in just a few megayears.

The planets of super-giant suns will make excellent habitable planets for any space-faring race . . . provided something can be done about the ultra-violet and soft X-ray output from such Type O, B, and A stars! You'd need something more than suntan lotion to protect you if you stepped out into the rigelight, for instance.

The chance of finding habitably-warm planets around any of the average-size stars—those radiating about 1/1,000th of the Sun's output—would be extremely small. However—there's an enormous number of such stars; the Sun is *not* properly described as a "yellow dwarf" star, for it is roughly one thousand times as luminous as the average star within the reasonably-well explored local volume of space. (Of the forty near-neighbor stars, only three are appreciably brighter than the Sun—Sirius, thirty times, Altair, ten times, and Procyon A, seven times.)

Moreover, any of those average-size dim stars which does have a habitable planet—is quite apt to have an inhabited-already planet, for those are the exceedingly long-lived, extremely-stable stars. So far as fuel-reserve goes, present knowledge suggests they could keep on shining longer than any present estimate of the probable duration of the Universe!

So if you're an interstellar explorer, looking for a planet which could be exploited and developed for human habitation, perhaps the place to look is around one of the easily-located super-giant suns. It'll be a temporary thing, of course, good for only a few megayears, but adequate. And because of the enormous depth of the habitable zone, such a star might well have several comfortable-for-human-beings planets, allowing the development of several close-neighbor worlds.

There's an enormous number of little suns; if you're looking for a good place to hide away a colony with a minimum chance of being noticed, it might be worth exploring some of those innumerable, and forever incompletely catalogued dim average-size suns. Something like "CD-37° 15,492" for instance, which is all the name the star has, which is about fifteen light-years away, and about 1/100th Sol's luminosity. The overwhelming number of such stars, scattered throughout the entire great disk of the galaxy, moving in extremely irregular and constantly perturbed orbits about the galactic center, means that no future civilization, however widespread and galactic in scope, will have the time and energy to bother cataloguing and keeping track of that swarming multitude.

You could lose a million cultures among them! And each as conspicuous as an individual blade of grass on a golf course, a thing you can look at readily any time you want to of course, yet can never find again if you turn your back on it for a moment!

But if you're looking for inhabited planets . . . there does seem to be reason to check first on the mid-range stars of about the Sun's mass and luminosity. Stable enough for life to evolve and develop, luminous enough to have a deep habitable-zone for planets to occupy.

Incidentally, Tau Ceti, that has been much discussed as a possible nearby inhabited star-planet system, falls in that last class. Tau Ceti is nearly as massive as the Sun, about one half as luminous, and of spectral class KO—slightly cooler and more orange than Sol. A good, competent, but not spectacular star, with a service-life well up in the multi-billions of years. A planet at Venus' distance from Tau Ceti would have a temperature much like Earth's.

The next problem seems to be the matter of checking out that business of flare-stars. It looks like a most interesting sort of clue, and one that may lead to some totally new kinds of answers! ■

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BRASS TACKS

Continued from page 5

the position of the oscillator disk center and the "center of gravity" line can be related at all times. A transparent piece of plastic, with vertical grid lines ⅛" apart, is convenient.

Then set up the means of observation. We must be able to closely observe and constantly relate, during rotation, the linear position of the oscillator in the plane of oscillation (using the center of the axis disk as oscillator reference) with the vertical reference lines of the exterior stationary grid. We must also simultaneously observe the rotational angles of the center of gravity of the eccentric mass (the heavy disk line) in relation to the plane of oscillation. For such observation we may use a simple controlled speed Newtonian disk, stroboscope, movie camera, or sensing mechanisms and oscillograph. At very low speed we can even get quite good approximations with nothing more than hand and eye.

Excellent results have been obtained with a 16 mm. movie made at 64 frames per second with the rotors at 120 r.p.m. Inspected frame by frame through a movie "editor," the resulting 32 frames per revolution are adequate for general observation.

We are now ready to go. What are we to look for?

First, look at what our textbooks say should happen as shown in Diagram No. 1:

(a) The amplitude of oscillation, they say, must always be twice the distance between (m) and (c), (m) being the center of gravity of the axis mass and (c) the center of gravity common to the axis mass and the eccentric mass (m-l) (less any friction or restriction).

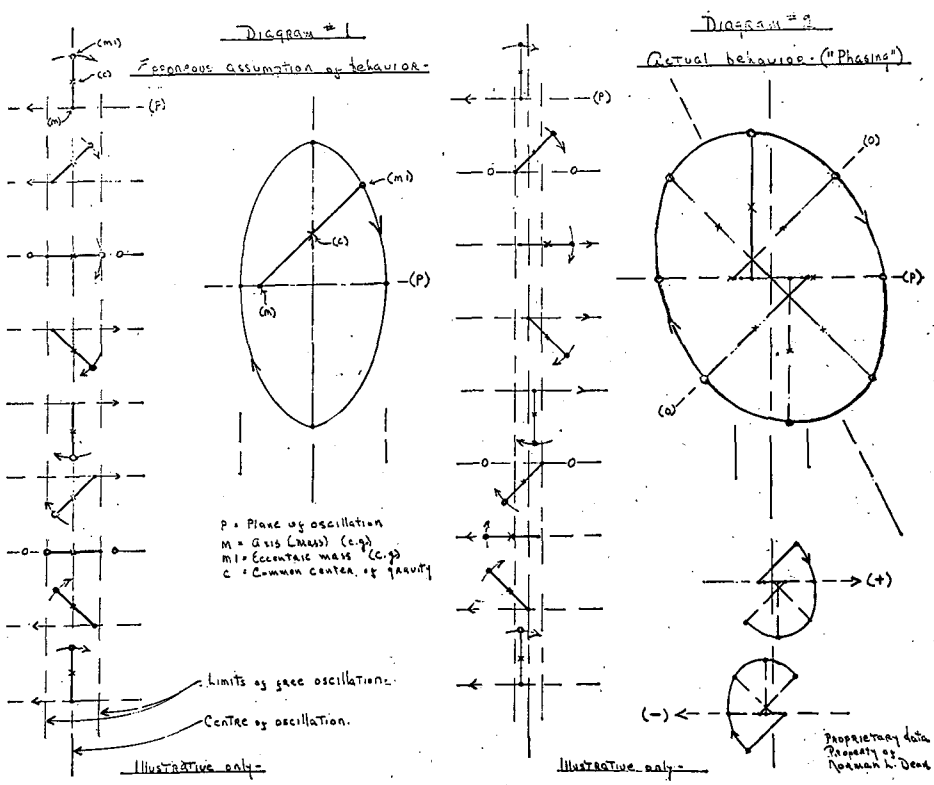
(b) The "shape" of the "orbit" of the center of gravity of the eccentric mass (m-l) is supposed to be an ellipse exactly *vertical* to the plane of oscillation.

(c) As the rotor is rotated, the center of gravity (c) common to the oscillator frame and the eccentric mass is supposed to oscillate *straight up and down* at a right angle to the plane of oscillation.

(d) We are told that the oscillator, using the axis (our disk center point) as reference, cannot begin to move in a reverse direction in the plane of oscillation until the center of gravity of the eccentric mass (in our disk's heavy line) *has passed the plane of oscillation.*

(Check the position of the disk's heavy line twice in each revolution against the exterior lines of reference. When it is fully vertical to the plane of oscillation above and below that plane in each revolution the disk's line [center of gravity] will have *alternated* between *two* exterior reference lines.)

(d) The oscillator, again using the center of the axis as reference, *does* begin to move as an entirety in a new



Now put the equipment in operation and see what happens.

Not one single item of the above has occurred.

Now compare what is happening with Diagram No. 2:

(a) The amplitude of oscillation tends to be *less* than twice the distance between (m) and (c).

(b) The ellipse is *not* vertical, but *tilted.*

(c) The center of gravity (c) does *not* move up and down in a straight line. It follows the *tilted* ellipse and is constantly, cyclically and alternately displaced in the plane of oscillation.

direction in the plane of oscillation *before* the center of gravity of the eccentric mass reaches the plane of oscillation. Roughly, the observable "zero" or "effective" angle will probably be about 45 degrees *before* it passes the plane.

For further observation, change uniform operating conditions. Add, for instance, constant and uniform friction of varying amounts in the plane of oscillation. Or change the weight of the oscillator frame. The "shape" of the patterns will vary, but it will be found that the elements of the oscillator dynamically resolve the forces in each cycle under the differ-

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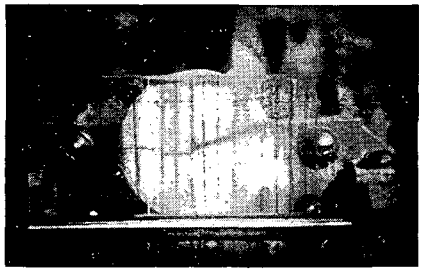
ent circumstances, *and that the above basic results and characteristics have not changed.*

It is therefore demonstrated that:

The center of gravity tends to be alternately displaced in the plane of oscillation by force exerted in that plane and by forces induced in the oscillator itself.



This is a still from a 16mm film of an oscillator in action with the reference lines described in the letter. Rotation and action are shown in Diagram No. 2.

Force is present and is exerted in alternate and sequential directions in the plane of oscillation. The alternating force is of wave form, each wave being of 180° duration from the "zero" (or effective) phase angle. The alternating waves can be considered as "positive" and "negative" *phases* of force.

They are equal and opposite, but they are non-simultaneous. They are sequential.

The "phasing" phenomenon is an inherent characteristic.

It should be noted that the "pattern" of behavior is clearly indicated in figures 1, 2, and 3, of the original patent referred to. It is stated in the text. The resulting cyclical, "phase" *thrust* effect is therein described. The complex forces are capable of analysis. The behavior is predictable.

We have considered specific behavior under uniform conditions for the purpose of observing and identifying the basic phenomenon. This behavior, purposely isolated and defined, must not be confused with other properties of the phenomenon.

For instance, the distance the axis (including frame) mass moves during a phase is not the measure of the realizable force potential of the phase. In accordance with standard dynamic principles, if the axis is restrained from motion in the plane of oscillation during the "positive" phase, under maintained constant angular velocity conditions, the measurable force exerted on the restraint during the phase, in terms of work, will exceed the force required to move the axis mass in the unrestricted, sequential "negative" phase, the amplitude of which will be one normal phase-displacement.

Under these circumstances, the restrained phase releases energy as force exerted on the restraint, and the unrestrained phase demands energy from the energy source, if constant angular velocity is to be maintained as required. Cyclical energy transference thereby occurs. "Impact" of any kind is prohibited under the System disciplines and practice.

The "phasing" phenomenon is only part of the System and the Drive. The System is the method of using the phenomenon to produce *repetitive continuing cycles of net unidirectional thrust* in a continuous thrust transmission system of commercially useful efficiency.

The System could be considered as an alternating force "rectifier." The disciplines, methods and dynamics of the System are not pertinent here. They concern, among others, the properties of the phenomenon, methods of energy transference, the principle that the induced forces in a rotating body are always greater than the inertia of its center of gravity, and the methods of distributing total input energy in the System to produce specific resultants.

What does the "phasing" phenomenon signify?

Theoretically, the phenomenon, and the System and the Drive of which it is a part, are correct projections of a basic concept of which the System is the third successful illustration, the others being in different fields.

Commercially, the System and the Drive, of which the phenomenon is a part, constitute a transmission system of unique characteristics, commercially useful and of competitive efficiency.

The significance that the phenomenon may have in other contexts is not here considered.

We should, perhaps, repeat that our foreign and domestic patents, issued, in process, or in attorneys' hands here and abroad, and which include the phenomenon, cover basic systems or methods. Our commodity is the basic process of which all variations and applications are a derivative.

The highly diverse physical and mechanical means of implementing the System are the business of System licensees and their engineers. The Dean System Space Drive is a general term or trade name for the resulting hardware.

American licensing is handled by or through the American division of a licensing company. Its business is with industry only. Technical assistance to licensees is through independent consulting and engineering firms. Information, data, design and "know how" are proprietary.

Many useful horizontal and vertical thrust applications of the Drive are known. These applications are the business of ordinary, present and competitive industry in this and other countries. One of such applications is the "car" your correspondent incorrectly terms "antigravity." But whether it rises first above the Potomac, the Seine, the Rhine, the Tiber, or the Thames, it will be designed for general use and manufacture, not for our astonishment.

NORMAN L. DEAN

P.S. As this letter concerns proprietary information and data all rights are reserved. N. L. D.

■ *This demonstrator at least is simple enough to set up and study! The full Dean Drive mechanism is too complex a machining and engineering job for the ordinary amateur to tackle—but this seems to be something a high-school group could assemble and demonstrate successfully.*

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THE WOLFCRIERS

"Outside" critics of science fiction generally point accusingly at our lack of social consciousness. We have the ability and the responsibility, they insist, to draw up the blueprints for a just-about-perfect future society and get the cattle—beg pardon, readers—headed in the right direction.

Such complainers point to the satire of Huxley's "Brave New World," or the grim warning of Orwell's "Nineteen Eighty-Four," as the kind of book we might be writing—but don't. These same people haven't read and wouldn't read any of the host of stories, long and short, which have preached those same messages in the same ways over the years. But that's not the point I want to make.

Science-fiction writers are—and have to be—wolfcriers.

Serious novelists like Huxley and Orwell can, and do, put all their talent into one or two "message" books and stop. Orwell warned against totalitarian techniques in one other piece of fiction, "Animal Farm," but it was in no sense, except theme, a repetition of "Nineteen Eight-Four." Superficially humorous allegory took the place of a realistic tragedy of the future. Huxley's other novel of the future, "Ape and Essence," is about as different in form and mood from "Brave New World" as two books of one another can get.

The serious science-fiction writer, on the other hand, if he decides to warn against trends in our society that may destroy us and our world, is almost immediately in the position of the legendary boy who cried "Wolf!" To achieve any stature in the science-fiction field, any acceptance from editors and readers, and any money in the bank, he has to write—and sell—pretty often. If he tries to put across the same message over and over again, he will pretty soon lose his readers, and then his editors, and then the money in the bank.

This is why the best and most serious writers in the field scatter their shots. Pohl and Kornbluth, and now Pohl by himself, have satirized most of the unlovable aspects of our society over and over again, and effectively enough so that the targets have yelled with pain and rage. But eventually the effect dulls and the regular reader finds himself passing over the meat and savoring the seasoning, the gimmicks, the bright detail.

Science-fiction writers, as a group, have imagined just about every variation in a totalitarian society that their very fertile minds could conjure up—and after a while the variations were what their readers were looking for. The same goes for almost any aspect of sociology you care to name. But we've stopped listening to *what* they say when they cry "Wolf!", and comment on their voices or enunciation.

A new book by an English author, "The Zilov Bombs," by D. G. Barron—W. W. Norton & Co., New York; 173 pp.; $3.95—is a case in point. I don't know the author's politics—he is an architect—or the reception the book may have had in England, but on the surface at least he is using the medium of science fiction to preach a warning to the "Better red than dead" school. His hero is one of that school, doing his best to hold to the creed in which he believes.

The story begins with deceptive quietness like many another English novel about a writer or artist and his family, trying to make a go of things in a seaside cottage. But within a few pages we know that this is 1973 and that for five years England has been part of a Union of Socialist European States, a Soviet puppet, ruled and occupied by Russian forces as eastern Europe is now. Because the author is more interested in his people than his stage props, the details are never entirely spelled out. Guy Elliott, in 1968, had joined other sincere pacifists in forcing American bases off English soil . . . then in bringing about unilateral disarmament . . . then in setting up a government that would "get along" with Moscow. And then, apparently, Moscow moved in to help its friends keep order.

The book is labeled "a novel of suspense"—not science fiction. In plot, it is a fairly quiet thriller. A friend of Elliott's, a conscript in the British People's Army, has shot two Soviet soldiers and gone into hiding with the truck he was driving. The truck contains the Zilov bombs—two small "clean" nuclear warheads. Representatives of an English underground want the bombs, for a purpose which develops as the story continues. The Russians want the fugitive, since he can tell them where the bombs are, so they take fifty hostages and announce that they will be shot unless Duncalf is turned in or gives himself up. But if he does so—and he intends to—the bombs will be lost and the security of the British Union for Survival endangered.

By sticking doggedly to his pacifist

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ideals, Elliott has helped make his country a Soviet-occupied satellite. He still cannot allow nuclear bombs to be used, even by the BUFS against the Russians—yet he has been drawn into the plot through loyalty and friendship. He tries, now, to pull out, to look the other way. And this personal conflict is really the basic conflict of the book.

There's nothing particularly novel about this plot from a science-fictional standpoint. Writers by the score have done stories about dogged undergrounds in occupied nations or planets. But this is not a story about Martians on Earth; it is about Russians in England, not in 2168 but in 1968, because the people who today say "Better red than dead" invited them in. It has, in other words, a far more direct and immediate message for English readers than "Nineteen Eighty-Four," though Barron is unfortunately not the writer Orwell was.

Americans as a people do not believe in the possibility of invasion by Russia or anyone else. Apart from some brief episodes in the War of 1812, which was still something of a family quarrel, we have not been invaded by foreigners—non-English-speaking enemies—since the French-and-Indian wars of two hundred years ago. Texans will, of course, make an exception for the Alamo and Alaskans for the Aleutians—the latter, at least, legitimately. The rest of the country can't take invasion seriously. England, on the other hand, has lived through Dunkirk, and the blitz, and the days when Hitler's invasion fleet was twenty miles away across the Channel. England knows very well that a war between Russia and the United States is almost certain to mean occupation and likely to mean cold-blooded destruction, if for no better reason than to deny American troops the beachhead we used against the Nazis. From where they sit, every choice in the Cold War is a far tougher choice than it seems for us—though it may well be the same choice—and "Better red than dead" is neither a vapor-headed piece of rhetoric nor subversion; it is a real alternative.

Through his "novel of suspense," his science-fiction book, D. G. Barron is asking his readers to look closer and think longer about what being alive but red-ruled can be like. Everything he describes has had its parallel in eastern Europe: the network of "loyal" informers; the ruthless collectivization of agricultural lands and stamping out of small farmers; the book purges; the "people's" police; the occupation forces. The deadly quietness and dullness of the envelopment is one of the book's most effective touches.

Buried in the main body of science fiction, "The Zilov Bombs" would lose most of its effectiveness. It would be just another variation on an all-too-familiar theme, realistically but too quietly played out.

Published as a suspense novel, the book may suffer the same automatic degrading. On the other hand, it may reach readers who would never look at it otherwise—the readers who don't *want* to be told that there are wolves abroad. They may say, "That's me!" when they see Guy Elliott.

Not, however, if he repeats his message in another story. Only preachers and politicians can repeat themselves and be heard, because they are selling revelation instead of reason. Entertainers—science-fiction writers—haven't that advantage.

THE BEST SCIENCE FICTION 1962

It may already be too late for those of you who are not already members of the 21st World Science Fiction Convention to nominate your choices for Best Novel, Best Short Fiction, Best Prozine—newsstand magazine, Best Dramatic Production—stage, film, TV or radio, Best Professional Artist, and Best Fanzine of 1962. The nominations may be made only by paid up Convention members, and must reach the Committee by April 15th.

You will still be able to cast your vote in the final ballot, based on these nominations, if you join later. Each category is generally weeded down to the four or five most popular titles or individuals for the final poll. Winners get the "Hugo" awards at the Convention, to be held at the Statler Hilton Hotel, 16th and K Streets, Washington 13, D.C. over the coming Labor Day weekend, August 30-September 2, 1963. Guest-of-Honor and dinner speaker: Murray Leinster, who stands among American science-fiction writers where Hugo Gernsback does among editors.

DisCon membership is $2.00, paid now to William H. Evans, Treasurer DisCon Committee, Box 36, Mt. Rainier, Maryland. This brings you the advance progress reports—two already out—plus the program booklet, plus other bonuses to be announced. If you attend, there'll be another $1.00 due at registration time. In either case, you have full voting privileges.

JOYLEG
by Ward Moore and Avram Davidson
Pyramid Books, New York.
1962. 160 pp. 40¢

As you know if you read the shorter serial version in *Fantastic* last spring, the bearded antiquarians of Southern California and Southern Brooklyn have created a purely joyful character in Isachar Z. Joyleg, the venerable individualist of Rabbit Notch, Unassimilated State of Franklin. In his comments on the times through which he has lived and the world in which he now finds himself, his spokesmen have wasted opportunities to look with a wry eye on the sometimes extraordinary differences between history and politics as they are and as they are recorded.

Joyleg, as a couple of well-meaning Tennessee Congressmen discover, has been collecting a veteran's pension of eleven dollars a month for a very long time. To the Honorable Lucinda Habersham, R., he is either a fraud or wasting the public purse. To the equally Hon. Tully Weathernox, D., he is being shortchanged. Then they discover, after a trip to Rabbit

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Notch, that the service for which Joyleg has been pensioned was as a Sergeant of Marines under John Paul Jones, during the Revolutonary War! Daily "soaks" in a particularly potent variety of Tennessee moonshine, originally devised by Isachar's daddy, has kept him hale through nine wives and many exploits to a final showdown before an anthropophagous Congressional counsel and some entanglements that involve the U.N. and the future of the world.

This is one, I predict, that is going to keep right on reading better and better with the years, like the "senior" author's "Bring the Jubilee" or the "junior" contributor's short stories.

THE EXPERT DREAMERS
edited by Frederik Pohl
Doubleday & Co., Garden City, N.Y.
1962. 248 pp. $3.95

These are science fiction stories by scientists, and a far better selection than the similar one in the Collier paperback series, earlier last year. Not only has editor/author Pohl made a better selection of scientists and their work; he has had imagination enough to use excerpts from novels to sample writers who have no good short fiction available. These are a vignette, "The Singers," from "The Curve of the Snowflake," by the English cyberneticist W. Grey Walter, and a bit from Fred Hoyle's "The Black Cloud."

In addition to these two, the scientists who sometimes write fiction include physicist O. R. Frisch with his classic "On the Feasibility of Coal-Driven Power Stations," beautifully dead-pan in every respect, Leo Szilard with "The Mark Gable Foundation," an investigation of the problems of longevity, George Gamow with "The Heart on the Other Side," a prank involving dimensions and relativity, and Norbert Wiener, alias W. Norbert, with "The Miracle of the Broom Closet," really a fantasy.

Then there are scientists who are just about as well known here for their fiction. Arthur C. Clarke, for example, with "At the End of the Orbit," an ironic little story of skin-divers and cosmonauts. Or Isaac Asimov, represented by "Lenny," the story of a positronic robot that needed mothering. Or Willy Ley as Robert Willey in "The Invasion," with its puzzle of how to get at the seemingly invulnerable other-wordlings. "Philip Latham," astronomer R. S. Richardson, had one of his farthest-out stories here in Astounding in 1951: "To Explain Mrs. Thompson." In it the head and shoulders of the deceased lady appear among the stars —and she never is explained. Chandler Davis' "Adrift on the Policy Level" satirizes the status bureaucracy to a fare-thee-well. "Chain Reaction" by the writing team of Lyle and William C. Boyd, alias "Boyd Ellanby," converts the unspoken guilt-feelings of some nuclear scientists into bitter psychological action, and "Lee Correy"—ex-rocketeer G. Harry Stine who was so thoughtless as to say "I told you so" when Sputnik I beeped into space—has another realistic story of the pressures of today in "The Test Stand."

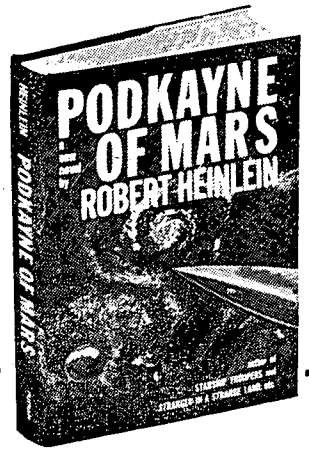
Finally, author "Lee Gregor," author of "Heavy planet," turns out to be plasma physicist Milton A. Rothman, old-time Philadelphia fan, almost outdoing the equally pseudonymous science-teaching "Hal Clement" with his construction of strange life on a stranger world. And George O. Smith, brazen user of his own name on all fronts, contributes "Amateur in Chancery," a pure Smithian puzzle story: how do you tell an extraterrestrial, who can't see you, the difference between left and right?

This is the grist that can be milled again, and Frederik Pohl is apparently the man to do it.

ANSWERS

1. *Glass, of course.*
2. *Clay.*
3. *The material that gave us the word "plastic"—the Greeks had a word for it,* plaston, *meaning bread dough. And if you think it isn't used as specified, try a tunafish salad sandwich without it!*

The new ROBERT HEINLEIN!



A REAL master of science fiction—winner of the Hugo Award—is at his very best in this thrilling and hilarious new novel, PODKAYNE OF MARS. It's all about a danger-crammed space journey from Mars to Venus in some future age when each of those planets boasts a Macy's and a Hilton! $3.50

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THIS SPACE CONTRIBUTED BY THE PUBLISHER

Japanese women rarely get breast cancer.

Research scientists don't know why, but they want to know. The reasons for the immunity of some groups of people to cancers common among other groups may reveal keys to the discovery of a preventive for all cancers. The American Cancer Society is supporting eighteen research projects on breast cancer. Write your A. C. S. Unit for our leaflet, "Breast Self-Examination." See your doctor every year for a health checkup.

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by JOSEPH GOODAVAGE

REPORT ON CRUCIAL EXPERIMENT DECEMBER

ASTRO FORECAST

"Between 1:30 and 4:00 a.m. EST on Nov. 27th there should be another activation of secondary electromagnetic disturbances in the high atmosphere . . . accompanied by auroral displays in the northern skies . . ."

"November's weather highlight . . . abrupt transition to critically cold wintry weather, intense storm activity, high wind velocities and snow stemming from the Pacific Northwest immediately after (Nov.) 27th . . . high and low pressure areas will converge over mountains and elevated areas . . . blizzards over Cascade Mountains and the Great Divide."

"On the night of Dec. 2nd, a drastic drop in temperatures will preview the dominating winter pattern. By this time, orthodox forecasters will be predicting a cold winter for the United States."

"A complex weather pattern in (the Northern Pacific) area indicates freezes, thaws, and mixtures of rain along the coast. Snow slides, caused by mild spells in the mountains, will be a danger around the 4th and 5th of December."

"The heaviest snowfall of the month, caused by a southing major low, centering over Calif. into Arizona on Dec. 11th will spill masses of snow over the Sierra Nevada Mtns. At the same time, polar air masses traveling eastward over northern regions will intensify. This depression will move eastward through the lower Mississippi Valley, breeding snow for the Atlantic coast over

ACTUAL WEATHER

". . . Some auroral activity occurred 12-15 U.T. on the 27th. It was only visible in Russia."

—IGY World Data Center A

". . . Almost daily precipitation in the Pacific Northwest, northern California and inland into the northern Rocky Mountains left snow at colder locales. Reports from Butte and Dillon, Montana . . . seven inches of snow at these sites, but was little compared to the four-to-six foot reports from higher elevations of the Cascades in Washington."

"WASHINGTON, Dec. 15 (UPI)—The Weather Bureau predicts more cold weather and snow for much of the nation during the next thirty days.

"In an extended forecast . . . it said temperatures through mid-January would be colder than normal over the eastern two thirds of the country. West of the Continental Divide, normal temperatures were forecast.

"There is a possibility of a good bit of snow in many areas during the thirty-day period, the Bureau indicated. These include the Atlantic Seaboard, the Southeast and northern Plains. It forecast above normal precipitation for these sections."*

"Although the Far West was predominantly dry during the week, Washington had mostly cloudy and rainy weather, and temperatures above freezing and rain at higher elevations resulted in a reduction of the snowpack." (Dec. 3rd to 5th)

"The areas of heaviest snowfall were in Michigan, Indiana, Ohio, W. Va., Penna. and New York, where many totals exceeding a foot were recorded at higher elevations or along the lee of the Great Lakes. However, light snow was reported from as far south as central Georgia. Most of the snow fell on the 5th-7th, but additional

*NOTE: Great Lakes Region omitted.

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the 12th-13th; the cold wave will intensify over mid-western states . . . in the wake of this storm the cold front will become more intense."

amounts fell after the close of the period (Dec. 12th-14th). Schools and roads were closed in many areas, powerlines were downed in W. Va., and drifts were reported 25-feet deep in Penna. At Paw Paw, Michigan, thirty-three inches were measured near the close of the week. Depths of ten inches were reported from the mountains of N. Carolina . . . Heralding the arrival of the frigid air were heavy snowstorms over the Great Lakes States and into the Central Appalachians, where the Cleveland area of Northeast Ohio had the greatest snowfall in eight years."

". . . Moderate temperatures extending southward *until the 10th* of the month will result from predominating, northing low pressure areas."

"One of the most severe December freezes on record moved over the eastern half of the nation as the most notable feature of the week's weather *after the 10th.* Numerous record lows were set for the month over the entire southeastern quarter of the Country."

"More heavy snows will be shunted off the Rockies southward, accompanied by a persistent low temperature trend over the northern border states from the Dakotas to Maine. The third week in December, however, will bring a milder trend of average temperatures to the north Atlantic Coastal areas."

"The (third) week's weather began mild, but took on a more winterlike appearance as it progressed . . . unseasonable warmth early in the period was enough to offset the numerous below-zero minima later in the week in the North Central region . . . Northern California received heavy precipitation with totals over one inch. The Northern and Central Rockies received snowfall ranging from eight inches in the mountains of Colorado."

"On Dec. 25th-26th, a low pressure area growing from the northern Pacific Coast will drift eastward and focus over the northern central states on December 27th and 28th. *Bitterly* cold temperatures, skidding downslope and eastward, will become even more intense *east* of Chicago . . . this will set the pattern for a *Saturnine* winter."

"Proceeding eastward from the North Pacific coast across the Great Plains, snow fell almost daily in the Great Lakes area. The entire northeast section of the nation was buffeted by gale winds, heavy snowfall and sub-zero temperatures."

Addendum:

The Mystery Diagrams which we published in the January "Crucial Experiment" section were not so intended; the underlying mystery is how all three divisions of the editorial staff goofed at the same time in the same way.

Goodavage was trying to show the different geocentric-aspects of the planetary bodies as seen at the Winter Solstice from (a) Washington, D.C., and (b) London, England. The observer is supposed to be facing *south* at 03:15 EST in Washington, and at 08:15 U.T. in London.

In Washington, all but four of the bodies are below the horizon; in London, all but three are *above* the horizon.

Europe certainly has been having a wild winter!

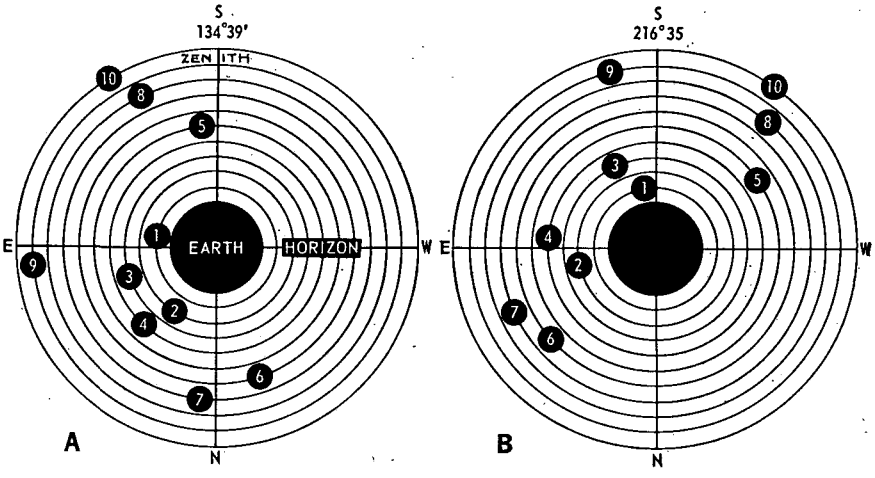

Fig. A: Washington, D. C., as celestial bodies are situated at the winter solstice, December 22, 1962, 03:15 E.S.T. as the observer faces SOUTH toward the equator. Geocentric longitudes used the Earth rotation counterclockwise.
Fig. B: Transposed for winter solstic at London, England, December 22, 1962, 08:15 U.T. where all but three bodies will be ABOVE the horizon.

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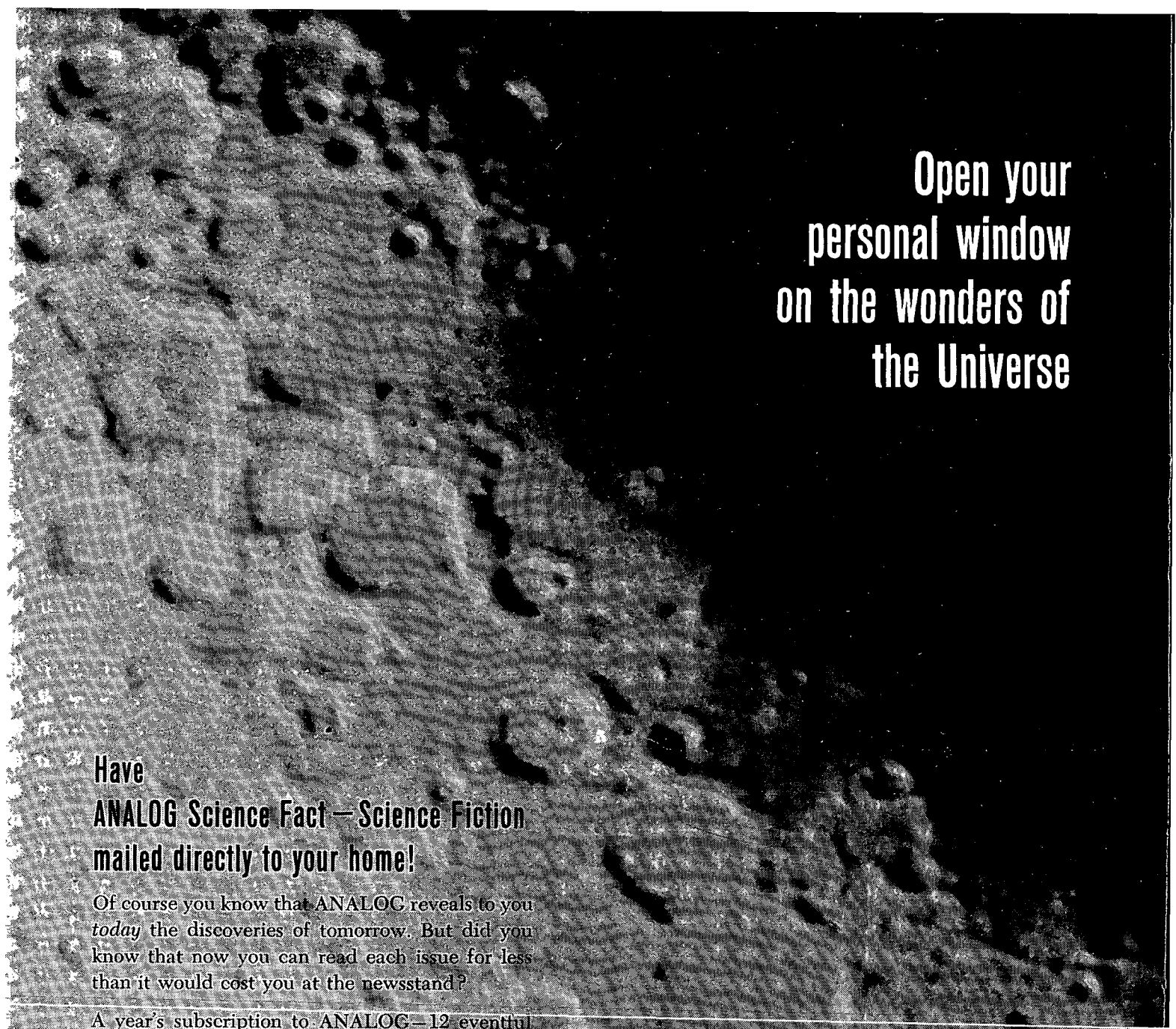

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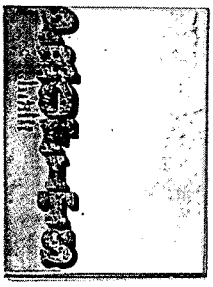
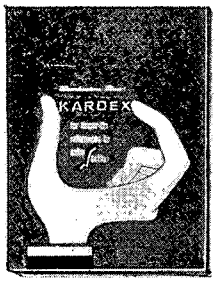
1 Need tighter control on accounts payable; collections and credit; sales, or service records? This booklet shows how to get it.



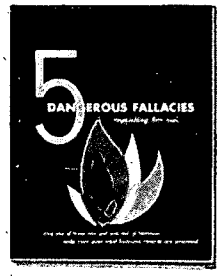
2 Must have tighter inventory control to prevent shortages, reduce rush orders, end ordering guesswork, prevent over- and understocking? You need this free booklet!

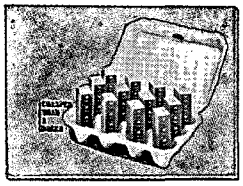
3 Want an up-to-the minute status report on sales and quotas, potential problems and sales opportunities—all at a glance? This booklet tells you how—at a glance!



4 If obsolete, disorganized files drain your company's profits, this free booklet is imperative reading.

5 43% of businesses struck by fire don't reopen. Could you stay in business if fire destroyed your vital records? This brochure could be a lifesaver.

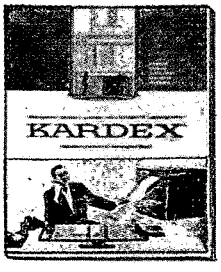




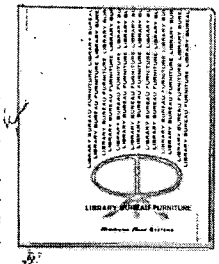
6 In a filing space squeeze? Learn how to file more in less space—and find it quicker—with this idea book.

7 Heavy user of card files? Discover how mechanized card filing saves you money, time, and space. This is a little folder with a great big message.

8 For fast, sure visible control of inventory, sales, production, personnel, maintenance, accounts receivable, tools, purchasing, you need to know what's in this free booklet.



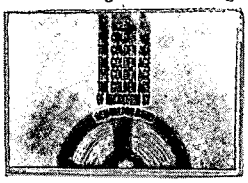
9 If you have or are planning a company library, you need the library equipment data, prepared by the Library Bureau.



10 Are filing cabinet log jams choking your office efficiency? Find out how pushbutton filing can save you money three different ways.

11 Are your file needs too complex for A-to-Z breakdowns? This vital booklet describes a system that sets you free of the confines of conventional filing systems.

12 Discover how Remington Rand can help you with microfilm, whether you now use it or not. Facts in this brochure will stimulate new ideas in record storage and handling.



There's a Remington Rand system for every business problem because Remington Rand makes all the systems.

SHORT CUT! Phone your nearest Remington Rand Office Systems branch right now. They'll send a man to help.

Remington Rand OFFICE SYSTEMS

DIVISION OF SPERRY RAND CORPORATION • 122 East 42nd Street, New York 17, New York

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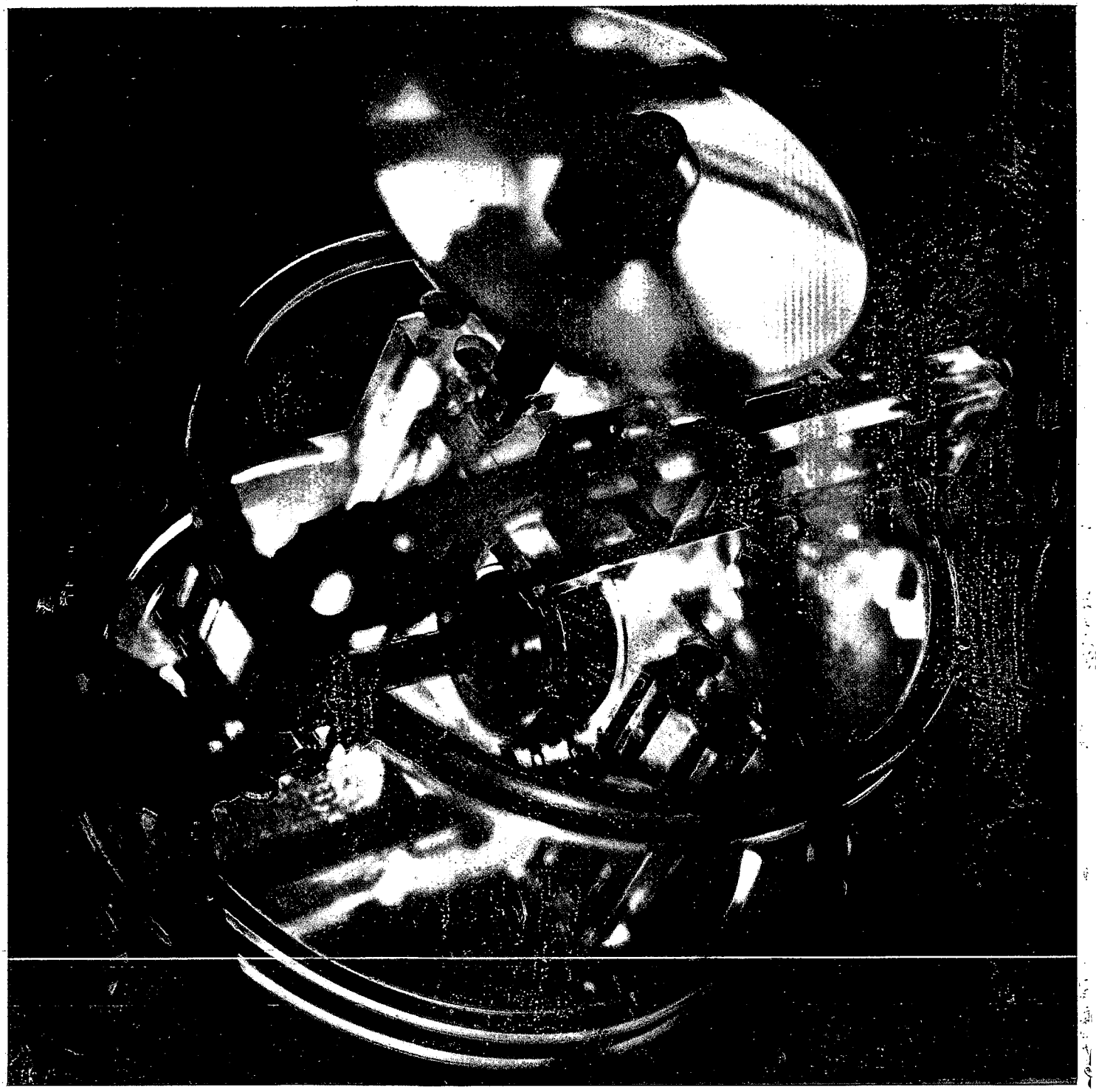

This is a gyroscope with no wheels, motors, gears, bearings, gimbals, rotors, springs or bushings.

The first magnetic induction nuclear gyroscope: a laboratory model, but functional enough to prove that the principle works. Its descendants are expected to be the most precise and dependable navigation instruments ever devised.

It has a heart of water, contained in a small glass sphere. Electrical coils around the sphere align the water's nuclear particles like bar magnets. When the gyro's orientation is changed, these particles are disturbed. They emit a faint current, which signals the change . . . with fanatical accuracy.

Good mechanical gyros also sense, and signal, change of direction. But as time goes on even the best of them will build up excessive drift. Since there are no moving parts in the nuclear gyro, its drift rate due to friction is zero. Because of its simple construction, it should eventually be produced at far less cost than mechanical gyros. And it will never wear out.

The one above was built under Republic's independent research and development program, and tested under Bureau of Naval Weapons sponsorship.

Tomorrow its descendants will guide men who travel on the sea . . . under it . . . in the earth's atmosphere . . . and beyond.

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